SOI: 1.1/TAS
DOI: 10.15863/TAS

ISSN 2308-4944 (print)
ISSN 2409-0085 (online)

№ 09 (65) 2018

Teoretičeskaâ i prikladnaâ nauka

Theoretical & Applied Science

Philadelphia, USA

Teoretičeskaâ i prikladnaâ nauka

Theoretical & Applied Science

09 (65)

2018

International Scientific Journal

Theoretical & Applied Science

Founder : **International Academy of Theoretical & Applied Sciences**

Published since 2013 year. Issued Monthly.

International scientific journal «Theoretical & Applied Science», registered in France, and indexed more than 45 international scientific bases.

Editorial office: **http://T-Science.org** Phone: **+777727-606-81**

E-mail: **T-Science@mail.ru**

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h Index RISC = 1 (66)

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ISSN 2308-4944

09

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International Scientific Journal

Theoretical & Applied Science

The scientific Journal is published monthly 30 number.

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International Scientific Journal

Theoretical & Applied Science

ISJ Theoretical & Applied Science, 09 (65): 406.
Philadelphia, USA

Impact Factor ICV = 6.630

Impact Factor ISI = 0.829
based on International Citation Report (ICR)

The percentage of rejected articles:

ISSN 2308-4944

Impact Factor:			
ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 2.031	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 01.09.2018 **http://T-Science.org**

SECTION 31. Economic research, finance, innovation, risk management.
UDC 334.722

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QUESTIONS OF CLASSIFICATION OF INSTITUTIONAL CONDITIONS, DETERMINING THE STRUCTURE OF BUSINESS MANAGEMENT IN UZBEKISTAN

Abstract: *The article deals with classical problems in determining institutional conditions, the formation of a competitive business environment, and the conduct of private business. During the analysis, the author identified the problems of forming a business environment. On the basis of this, the directions of increasing business activity of business entities in the Republic of Uzbekistan are proposed.*

Key words: *business environment, institutional environment, infrastructure, classification, entrepreneurship, business structure, Strategy of economic development of Uzbekistan.*

Language: *English*

Citation: Kurpayanidi KI (2018) QUESTIONS OF CLASSIFICATION OF INSTITUTIONAL CONDITIONS, DETERMINING THE STRUCTURE OF BUSINESS MANAGEMENT IN UZBEKISTAN. ISJ Theoretical & Applied Science, 09 (65): 1-8.

Soi: http://s-o-i.org/1.1/TAS-09-65-1 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.1

Introduction

Institutional conditions for the formation of small business should be perceived as a set of rules and mechanisms forcing small business to the implementation of these established rules and norms. Even insignificant dynamics of the institutional structure affect significant, if not decisive impact on subsystems, including number and on business structures [1]. Institute, rules, special guarantors of rules are mandatory elements of institutional conditions in formation of small business.

There are radical macroeconomic transformations in modern Uzbekistan, the ultimate goal of which is the implementation of transition to an open socially-oriented market economy. Thereby the structure of business is changing under the influence of resource, conjuncture and institutional factors.

Analysis of the literature on the topic

Fundamental moments of the theory of entrepreneurship, small business in the conditions of institutional transformations are stated in the works of known foreign economists J. Galbraith [2], D. Deakins [3], P. Drucker [4], A. Marshall [5], A. Smith [6], B. Santo [7], K. Tateisi [8], A. Hosking [9], J. Schumpeter [10] etc. Among the most important studies that illuminate certain aspects of development of small business in the CIS, it is necessary to note such authors, as L. Abalkin [11], V. Avtonomov [12], A. Blinov [13], T. Koichuev [14], O. Krivoruchko [15], M. Lapusta [16], A. Orlov [17], E. Primov [18], V. Rube [19], F. Shakhmalov [20], A. Yudanov [21] and others.

The peculiarities of the formation and development of this sector of the economy were the investigations of A. Khikmatov [22], B. Berkinov, M. Ikramov[23], N. Mahmudov, M. Tursunkhodzhaev, Z. Hudayberdiyev, V. Baturina, D. Trostyansky and others.

Directly to the development of small business and private entrepreneurship in new institutional settings were devoted the dissertation works of A.Akhmediyeva, U. Validzhanova, O. Ismailov, L. Ishmukhamedova, S. Salaev, I.Tursunov, E.Ergashev, M.Eshov and others. The main focus was on regional or sectoral aspects of the solution of this problem. However, the areas of research for the problem for the last time has changed somewhat from analyzing common problems of small business (place and role in the economic system, in solving social problems, employment problems, etc.) to the

analysis of the reasons constraining its development and search of conditions activation of small business. At the same time, practice shows that despite all efforts to activate small business from the government side at various levels from national to regional, there is no need to discuss about a radical improvement in the situation. This is explained as the multifaceted nature of the phenomenon of small business, and the variety of conditions for its functioning. Therefore, despite a large number of publications, devoted to various aspects of small business, the research of the problem requires further development. In particular, institutional conditions that determine the structure of entrepreneurship in Uzbekistan has hardly been investigated.

Research Methodology

Instrument-methodical research apparatus is based on application, within the framework of the system approach, general scientific methods of research: logical and situational analysis, expert assessments, questionnaires, observation, interviewing, groupings, comparison. These tools have been used in various combinations at different stages of the research, which allowed to ensure the scientific reliability of the final results, conclusions and recommendations.

Analysis and Results

In 2016, a number of systemic measures were taken to create conditions for doing business, attraction of foreign investments for small and private entrepreneurship, which are the basis of development of the economy of Uzbekistan. In October 2016, the President of the Republic of Uzbekistan Sh. Mirziyoyev issued a Decree "On additional measures for ensuring the accelerated development of entrepreneurial activity, all-round protection of private property and quality improvement of business climate "[24], aimed at creating an even more favourable business environment by eliminating all types of unscheduled, counter checks and removal of barriers. Particular attention in this document is given to the adoption of the effective measures to ensure the dynamic modernization of small enterprises and to stimulate their export activities, which should become the main direction of economic growth in the development of industries and regions, ensuring employment of the population, as well as additional measures on further stimulating the participation of small business and private entrepreneurship in exports.

In accordance with the Decree of the President of the Republic of Uzbekistan "On measures to radical improvement of the system of state protection of legitimate interests of business and further development of entrepreneurship" dated June 19 2017 [25], as well as the Resolution "On the improvement of the organization activities of the Chamber of Commerce and Industry of the Republic of Uzbekistan "[26] a profound reform of the activities of the Chamber of Commerce and Industry is carried out through a review of its tasks, functions and powers.

Implementation of measures to ensure reliable protection of private interests of small business contributed in 2016 to a dynamic development of this sector. Added cost of products of small entrepreneurship in the country's gross domestic product during the year grew and amounted to: 43.1% - in the I quarter, 46.0% - in the II quarter, 54.6% - in the III quarter and by the end of the year it reached 56.9%, exceeding by 0.4 percentage point to the level of 2015. During the year an increase in the share of small business in GRP of Jizzak (from 61.6% in the first quarter to 80.3% by the end of the year), Namangan (from 68.2% to 80.3%), Samarkand (from 67.7% to 78.0%), as well as in the Surkhandarya, Khorezm, Syrdarya, Bukhara and Andijan regions [27].

In 2016 structural changes in small business intensified in the direction of growth in the share of industrial products, paid services and retail turnover, which increased to 72.9%. Decreased the share of agriculture, forestry and fisheries and construction works to 27.0%, as well as agriculture from 20.9% (I quarter) to 18.8% (by the end of the year) and construction works, respectively, from 9.4 to 8.2%.

At the end of 2016, the number of people employed in small business amounted to 10392.5 thousand people against 10178.9 thousand people in 2015 (growth of 2.1 percentage points).

Institutional support of business entities in the past year has been marked by a significant increase in lending. So, allocated loans of about 16 trillion UZS, with 1.3 times growth by 2015, including 3.3 trillion UZS microcredits. Measures taken to form a business environment, comprehensive support and further stimulation of development small business and private entrepreneurship contributed to the creation of about 32 000 new small business entities in 2016. As a result, the share of small business in GDP increased to 56.9% (56.5% in 2015), in industry up to 45% (40.6%), in investments up to 40.3% (36.3%) and in employment to 78.1% (77.9%).

Based on the studies carried out, it is possible to determine the nature of changes of these factors and the specific features of their influence on various structural characteristics of business (table 1).

Table 1

Factors and structural characteristics of business

Type of factor	Time lag impacts on structural indicators	Structural characteristics, most highly dependent from this factor	Type of change
Institutional factors	*Significant. positive*	*The form property, scale of business, volumes of loans and investments, intensity and forms cooperation of small and big business*	*Slow for basic formal rules, socially rooted Informal institutions. Fast for discrete mutable formal regulations*
Conjuncture factors	*Close to zero*	*The volume of loans, amount investment, the number employed,*	*Rapid*
Resource factors	*Positive, small*	*Industry*	*Slow*

Among the many factors that influence the results of production and economic activity, a special role belongs to institutional factors. Currently, the most relevant is the treatment of the winner of the Nobel Prize in economics of 1993 "For the revival of research in the field of economics, thanks to application to them of economic theory and quantitative methods, allowing to explain economic and institutional changes" Douglass Cecil North. D. North notes the importance of various institutions in the historical context, he considered economic development of countries of Europe and the United States in the context of the industrial revolution. Based on this he puts into the concept of the institution "the rules of the game in society or more formally, created by people constraints, forming people interaction"[28]. Institution conditions is meant as a stable complex formal (laws) and informal (contracts and voluntarily accepted codes of conduct) of rules, principles and norms, as well as coercive factors, structuring their interaction.

There is no specific idea in the former Soviet countries as to which institutions are needed for the successful establishment of a market economy, how they are interrelated, ignoring legal, economic, as well as moral and ethical psychological basis of their formation[29]. This led to predominantly discrete, point-like nature of institutional transformations, many of which did not contribute to economic growth, as they did not justify.

In our opinion, especially in the conditions of transformation of socio-economic systems that the problem of institutional transformations acquires a special significance, not yielding to the financial stabilization.

Thus the state can adhere to two strategies of behaviour:

- promote the organization of these institutions;
- directly establish these institutions.

At the same time, public institutions, such as legal ones, belong to the sphere of government activity. Quasi-public, institutions of financial sphere, in the field of accounting and insurance, may transferred to the private sector. Institutional environment of small entrepreneurship is determined on the basis of a set of institutional conditions. It includes the most common political, economic, and social rules, on the basis of which the limits of norms, functioning and behaviour of small business entities are built. For rational formation of a set of institutional conditions, knowledge is necessary essence and specificity of each of them, take into account their existing structural co-ordination. The resulting classification can vary according to the criteria included in the review.

It is proposed to distinguish between the institutional conditions of direct and indirect influence. The first force small businesses to be based on the instructions of the government, and not on an independent economic choice when making decisions. The most striking example is the fiscal tools, as well as well-known volume requirements depreciation charges. These environmental conditions are characterized by high efficiency, as the economic result is achieved operatively. At the same time, they have a number of shortcomings. It should be noted that many different entities operate in the economy, as a result which forms a certain system of connections between them. As soon as the state imposes a specific decision, the consequence is the emergence of a reaction to it, even in those agents of the market, on which state measures were not directed. Consequently, the already existing equilibrium between market participants will be violated, and, therefore, it can be argued that the institutional conditions of direct impact can disrupt the natural development of market processes. In contrast to the institutional conditions that have been already, considered direct effects do not violate the

market situation. Their essence lies in the fact that the process of decision-making by the entrepreneurship entities, state does not have direct intervention. His task is to create a set of prerequisites so that the entities in case of independent choice of rules of action, such options considered as the most expedient, which correspond to the goals of economic politics. It is advisable to note that a temporary interval between the moment when the state takes measures and reacts to them economy with subsequent changes in the results of management.

In addition to this, it should be noted that indirect measures are characterized by heterogeneity in terms of the degree of influence on the acceptance by entrepreneurship entities of independent solutions. Due to the fact that concepts "institution" and "institutional conditions" are inseparable, we should single out the most fundamental, forming institutions, and then consider classification of the analysed conditions on their basis. According to the results the first group is represented by power and political institutions, which include the executive and legislative power; second - economic institutions that contain financial and taxation systems, business institutions, its infrastructure support; third group includes the ideological institutions that determine the motivation for initiative activity, culture of business relations, system of values. Based on the classification of the main institutions, we will understand that administrative conditions - institutional conditions of first group, and about the economic and ideological, respectively, the second and the third.

Do not ignore the range of problems that are solved through favorable institutional conditions [30, 31].

Classifying according to this feature, we distinguish the following species of institutional conditions (Fig. 1):

- ensuring the competitiveness of enterprises and the economy;
- increasing the efficiency of the use of potential;
- creation of jobs by opening new production facilities;
- formation of strategic development zones (by type of free economic zone in Navoi city, Kokand city, etc.);
- equalization of interregional inequalities;
- development of interaction at the level of countries and regions.

Institutional conditions are differentiated depending on the level of consideration: the lowest level - local, with the growth of the scale of influence - municipal and regional, the highest level - national. Depending on the degree of development and functioning, institutional conditions are subdivided by significance level for large, medium and small.

In the work of Corresponding Member of the Russian Academy of Sciences, Doctor of economic sciences, Professor G.B. Kleiner, the concept of formation and transformation of institutional systems – groups interrelated institutions, functioning within the framework of socio-economic objects of various levels are being developed: from enterprises to the country as a whole. The author developed the theory of a systemic economy, according to which the economy is viewed as a creation, functioning, transformation and interaction of economic systems from the point of view of the processes. G.B. Kleiner showed, that the systemic economy is a generalization and development of neoclassical, institutional and evolutionary economic theory.

At the same time, the author emphasizes the evolution of the system of economic institutions, leads a set of indicators that allow to characterize each institution. To this review, his proposed criterion is the type of subjects to be covered by the data of institutional condition. These include citizens, organizations, legal entities, employees of the enterprise, regions of the republic, etc[32].

Turning to the consideration of the small business itself, a set of factors (including non-institutional ones) that are more influential on its activity will be presented as follows:

1. state of the economy and market conditions;
2. the importance of the relevant infrastructure;
3. the policy of the state in relation to small business;
4. the influence of the social environment.

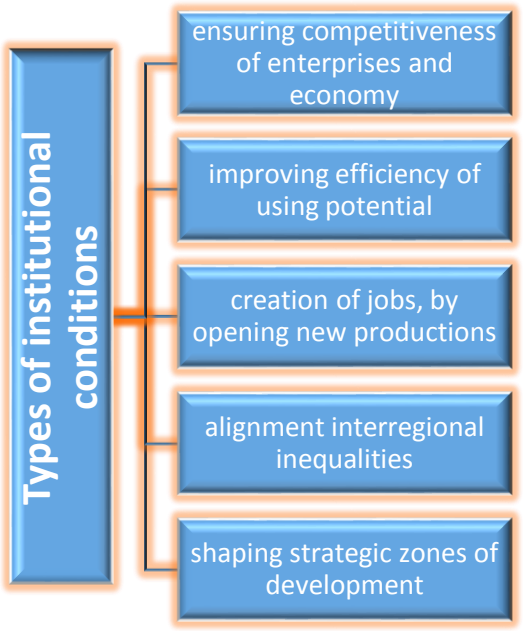

Fig.1. Types of institutional conditions.

The first group of factors is the state of the economy and the conjuncture. It is known that the development of the economy is characterized by cycle - the rise are replaced by recessions, the crises are revitalization, which has an impact not only on the economy as a whole, but also on the position of small entrepreneurs. Scientists do not observe a single point of view about the period in which the cycle is small business has the most favourable ground for its development. Some of them stand on the position that the largest surge of small business accounts for the periods of economic recovery and rise. The growth of production, income and wages, an increase in demand, and together with their prices and offers of goods occurs during this period. Expansion of the market provided favourable conditions, there are niches for small businesses. Another part of economists believe that there is a potential in a small business that facilitates the periods of recessions and even crises. During this period, production and a lot of businesses are bankrupt, experiencing a significant underload of production capacity, large enterprises have to resort to reducing the staff of their employees. The result os similar tendencies are growth of tension in the labour market. For most people creating their own business is the only an exit from the situation. As a rule, these are small firms from the owner and his family, so they stop their activity when the owner finds a job.

The carried out researches allow the author to allocate the first position.

The question studied was formulated in such a way that the first issue is not the number of newly created entities in this sector, but the dynamics of its development.

From this we can conclude that the infrastructure for supporting small businesses should include three main components (Fig. 2).

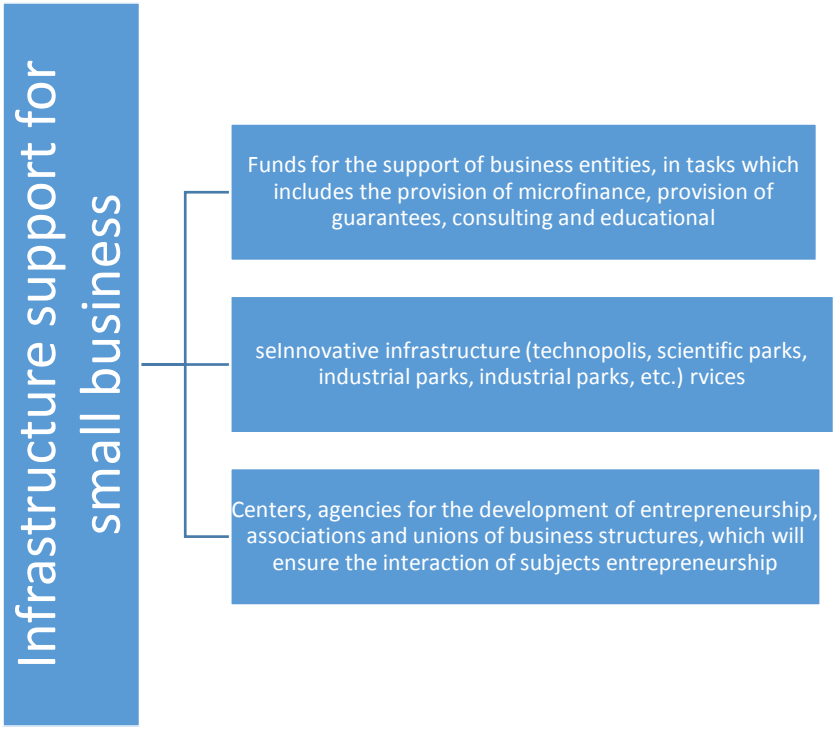

Fig.2. Small Business Support Infrastructure

Together, this makes for a small business the infrastructure that contributes to the development of this sector of the economy. The third group of factors is connected with the state regulation of this sector. State support plays an important role in its present and future. It can both contribute to and hinder its strengthening. Participation in the life of small business is carried out through ensuring favorable conditions for the development of small business. It may be: ease of reporting, tax benefits, security state orders, reduction of the working shift. Respectively absolutely opposite will be the conditions for a negative attitude of the government.

A similar range of issues, but somewhat differently, is explored in the work of analysts of the United States Agency for International Development, devoted to support of small business in the CIS countries [33]. So, Western scientists define the external environment of a small enterprise as a set of elements (markets, market institutions, processes, relations), directly influencing the formation and functioning small business. Five groups are identified that include elements of this environment:

- Resource and sales markets, being key to small business, are included in the first group;
- the second group includes the most important for small business market institutions and agents, in the role of which is a big business;
- Blocks of public organizations: legal, socio-cultural, political, expressed, respectively, in legislation, traditions and norms of morality, the alignment of political forces constitute the third group;
- in the fourth group, socio-economic processes and phenomena, such as crime, ecology, scientific and technical progress, the structure of the country's economy;
- The fifth group is a small business support system.

Conclusions and offers

The foregoing allows us to conclude that in two approaches there is a similarity, but their difference is of particular interest to the author, as for the researcher of the small business sector. Factors of external environment, indicated in the first approach, affect not only the small, but also the large business, even the entire economy of the country. The advantage of the second approach is that the specification of these factors allows one to see directly on the characteristics of the smallest business[30]. They are the following: the location of resource and distribution markets, informal relations with a narrow range of suppliers. Thus, the study of modern entrepreneurship with the use of an institutional approach is promising direction in economic science. Institutional theory allows identify the underlying, essential changes that contribute to the emergence of entrepreneurship in the country. The role of institutions is to provide entrepreneurs with the best opportunities to create a new enterprises, as well as create favourable conditions

for its further functioning and development. Institutional environment establishes rules of games understandable to all business entities, and forms the necessary conditions and incentives for business. Institutional environment has a significant impact on speed, nature and aspiration of individuals to business activities, providing direct and indirect impact on their behaviour.

At present, the formation of institutional conditions for free enterprise is understood as development. In our opinion, this process should be activated, carried out in line with[34]:

- optimization of the functioning of legal institutions with the help of elimination of duplicative and unnecessary laws, that is, simplification;
- decentralization - the transfer of administrative and legislative regional offices in order to bring local authorities to the real life and pressing problems of the entrepreneurship;
- expansion of the responsibilities and opportunities of individuals, for means of deregulation.

Thus, the formation of a clear representation of realistic existing system of institutional conditions, will determine, in implementation of the Strategy of Action for the five priority areas of development of the Republic of Uzbekistan within the period from 2017 to 2021 [35], the vector of institutional transformations for the coming years.

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Impact Factor:	ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
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SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 02.09.2018 **http://T-Science.org**

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SECTION 11. Biology. Ecology. Veterinary.

INFLUENCE OF LENGTH STEM UNDER WATER AND DEPTH WATER ON VEGETATIVE GROWTH OF PAPYRUS AND REEDS IN MARSH AL- CHIBAYISH

Abstract: *This investigation was carried out during season 2017 at 30 march on plants of papyrus and reeds grown in marsh east 30 km at AL- Chibayish, Nassria Governorate in area Ishan Goba at length stem under water 100 - 150 cm and quality of water. The plants were grown in silt soil . The experiment included the local cultivar plants of papyrus and reeds with three replicates and the replicate 5 plants . It is adopted according to Randomized Complete Block Design (RCBD), and the results were statistically analyzed according to Duncan test at the probability level of 5% . Results showed that, leaf area, leaf moisture, number leaves / plant, leaf thickness, number of nods, total chlorophyll and firmness of pulp on plants of stem at length 100 cm from soil more than plants of stem at length 150 cm from soil . The best water quality was increased with decreasing depth from surface water .There were a significant effect between treatment .*

Key words: *length stem under water and depth water, papyrus and reeds in AL- Chibayish marsh.*

Language: *English*

Citation: Al- Hameedawi AMS (2018) INFLUENCE OF LENGTH STEM UNDER WATER AND DEPTH WATER ON VEGETATIVE GROWTH OF PAPYRUS AND REEDS IN MARSH AL- CHIBAYISH. ISJ Theoretical & Applied Science, 09 (65): 9-12.

Soi: http://s-o-i.org/1.1/TAS-09-65-2 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.2

Introduction

The marsh world is considered for its natural social constituents an extension to ancient history owing to the continuation of primitive life features building reed houses, making boats, transport and fishing, despite the huge progress in these features in the world. Its described as rare from in the world (Klaff, 2005). Its historical and legacy in civilization still continues in its special world. These natural areas which are not polluted by elements of modern development are known as virgin areas, which the international organizations endeavor to protect . They call them "the protected areas in the world", represented by (virgin woods, rivers that have no establishments on them, human primitive units and areas not damaged by are limited in the world and the Iraqi marches are within these quantifications. In brief, it is a territory with some parts flooded with water throughout the year and some parts flooded quarterly. It has own unique geographical character (Azzam, et. al.2010). Before 2003, the marshes were drained to 10% of their original size (Cutis and Najaha, 2006). Upon the importance of marshes, successive governments beyond 2003 in ordination with international and regional and local organizations to relief and rehabilitate rashes but these efforts never achieved its objectives as to that there are many international and external obstructions (Ahmad, 2012). The location Ishan Goba north AL- Chibayish beside Euphrates river on the south . The out lest of these marshes discharge to Euphrates and Hammar marsh through groups of ways and bridges on AL- Chibayish – Mdaina road, especially between Almdaina and Alfhood. The discharge of these is about 1500m^3/s during floods. Papyrus is grown completely in marshes throughout AL- Chibayish area Nassria, Iraq. The stems pulp is eaten by people with very good test and the local name of it is " AL-Egeed" .People prefer " AL-Egeed" during spring time because it becomes fresh and less firm .There is another plant which is eaten and named " AL- Kareed".It represents the flower of the plants and it is taken during May each year . The meathead to prepare it is the flowers and pollens put out upon special screen and under some of water vapors which leads make it firm. This method were used from thousands years ago by AL-Summareen (Wilfred, 1960). Al-Saady (2008) found that, the

water in the beginning of marsh (western side) is of low color values that increase towards the end of the marsh and the water color was altered from yellowish at the mid of marsh to yellowish reddish at the end of it. Water's color for the second season is of less intensity than the first season while the feeding water is colorless. The samples of water in the mid of marsh characterized by disliked odor especially in the first season, and the result showed that the marsh water's temperature was affected directly by air temperature because of low depth. Marsh water for two seasons has low alkalinity and with less alkalinity than feeding water and with low content of dissolved oxygen and high content of carbon dioxide in the first season compared with the feeding water. Most of samples especially of the marsh margins characterized by hydrogen sulfate content while the water in the second season and feeding water for two seasons lack this gas. In the second season the marsh water has high content of DO and CO2 compared with feeding water and have high content of DO relative to first season. Marsh water for two seasons with higher content than total dissolved solids relative to feeding water and the average content of first season is higher than the second season. The types of marsh water for first season range between sodium sulfate, calcium-sulfate and sodium chloride and for the second season's varies between sodium chloride and sodium sulfate while the feeding water varies between calcium sulfate in the first season to sodium chloride in the second one. Marsh and the feeding water content of elements such as (Cd, Pb, Ni, Co) without cobalt of feeding water in the second season is higher than suitable limit for drinking and agricultural water and within the suitable limit of animals drinking water. Substance found in sources of water, point sources pollution and non point sources pollution effect in growth pants water (Radwan et al., 2003).The plants marsh gave good growth with the best water quality parameters, water depth and light (Horne and Goldman, 1994) .The purpose is to study growth plants of papyrus and reeds and quality of water in marsh AL- Chibayish,

Materials and methods

This study was conducted in area Ishan Goba in Marche distant 30 km east AL- Chibayish, Nassria Governorate during at 30 march 2017 on plants of papyrus (*Typha anguststa* L.) and reeds (*Phragmites commons* L .) that grown in silt soil to investigate the effects of immerse stem length (100 – 150 cm) from soil on vegetative growth parameters. The experiment included the local cultivar plants of papyrus and reeds with four replicates and the replicate 5 plants . It is adopted according to Randomized Complete Block Design (RCBD), and the results were statistically analyzed according to Duncan test at the probability level of 5% (Al-Rawi and Khalf Allah, 2000). The leaf aria cm^2, Percentage of leaf moisture, number leaves / plant , number of nods, leaf thickness mm and length of plant cm according to (Ibrahim, 2010). Firmness was measured with an Effegi penetrometer (Model NI, McCormick Fruit Tech, Yakima, WA) Fitted with an 11.1mm tip . Total chlorophyll mg /100 gm F.W according to (A.O.A.C, 1985). pH of water with pH meter . Ec of water (µs/cm) with Ec meter . Turbidity (NTV) according to (Fermanich, 2003) . Total Suspended Solids (T.S.S) mg/L according to (EPA, 2003) . Total Dissolved Solids (T.D.S) mg/L according to(Cole, 1983) . . Color of water (PCU), Total alkality mg/L and Total hardness mg/L according to (Bagley et al., 1997) . Soluble CO2 mg/L and Soluble DO mg/L L according to (Golterman, 1978). Heavy elements Cadmium (cd), Cobalt (Co), Chromium (Cr) and Nickel (Ni) was determined by using Atomic absorption spectrophotometer (Eisenmann, 2001) .

Results and discussion

1-Leaf aria, leaf moisture, number leaves / plant, leaf thickness, total chlorophyll, length of plant and firmness of pulp in plant papyrus .

The data in table(1) indicate that, plant papyrus which grown on stem at length 100 cm from soil led to a significant increased in the leaf aria, leaf moisture, number leaves / plant, leaf thickness, total chlorophyll, length of plant, firmness of pulp compared to plant papyrus grown on stem at length 150 cm from soil . The highest rates (56.58 cm^2, 80.73 %, 9.22, 5.17 mm, 128.45 mg/1gm FW, 210.23cm and 5.83 kg/cm^2) in the plant grown on stem at length 100 cm from soil in comparison to the lowest values rates (53.95 cm^2, 80.52 %, 7.64, 3.98 mm, 123.21 mg/1gm FW, 200.51cm and 5.72 kg/cm^2) in plant grown on stem at length 150 cm from soil , respectively . Increasing leaf aria, leaf moisture, number leaves / plant, leaf thickness, total chlorophyll, length of plant, firmness of pulp in plant papyrus grown on stem at length 100 cm from soil due to the fact that parts growth were to be exposed to air more than plants grown at length stem 150 cm from soil and thus encourages the accumulation carbohydrate materials in leaves and this enhanced characterize of vegetative (Abo-salam, 2009) . Also the quality of water effect on plants growth of marshes tables(3 and 4) . These result are in line with (Boyd and Claude, 2000) on plant marches they mentioned that plants gave the higher growth vegetative in best water quality.

2-Leaf aria, leaf moisture, number leaves / plant, umber of nods, total chlorophyll, length of plant and firmness of pulp in plant reeds .

Concerning the results in Table (2), leaf aria, leaf moisture, number leaves / plant, umber of nods, total chlorophyll, length of plant and firmness of

pulp in plant reeds were significantly affected by length stem plant immersed from soil . It is cleared that plant reeds which grown on stem at length 100 cm from soil increased compared with reeds grown on stem at length 150 cm from soil . The plant reeds which grown on stem at length 100 cm from soil gave the highest parameters they were (28.79 cm^2, 83.61 %, 7.34, 7.82, 109.32 mg/1gm FW, 418.55 cm and 9.59 kg/cm^2) in comparison to the lowest values (26.46 cm^2, 82.27 %, 6.70, 6.20, 101.85 mg/1gm FW, 418.55 cm and 7.96 kg/cm^2) respectively . The reason of increasing the leaf aria, leaf moisture, number leaves / plant, umber of nods, total chlorophyll, length of plant and firmness of pulp in plant reeds as a result of the growth stem length from soil. Decreasing soluble DO and increasing the pH, Ec, turbidity, total suspended solids, total dissolved solids, total alkality, total hardness, soluble CO_2 and heavy elements (Cd, Co, Cr and Ni) in water of marche area Ishan Goba with increasing the depth of water, which results through Tables (3 and 4) due to the fact that this compound decrease in the percentage of growth in plant reeds .

Table 1.

Effect of length stem under water from soil on growth plants Papyrus for season 2017.

Papyrus	Leaf aria cm^2	%Leaf moisture	Number leaves / plant	Leaf thickness mm	Total chlorophyll mg / 100g FW	length of plant cm	Firmness pulp 30cm from soil kg/cm^2
Stem plants at length 100 cm from soil	56.58a	80.73a	9.22a	5.17a	128.45a	210.23a	5.83a
Stem plants at length 150 cm from soil	53.95 B	80.52a	7.64b	3.98b	123.21b	200.51b	5.72a

Means followed by the same letters are not significantly different.

Table 2.

Effect of length stem under water from soil on growth plants reeds for season 2017.

Reed	leaf aria cm^2	%Leaf moisture	Number leaves / plant	Number of nods	Total chlorophyll mg / 100g	length of plant cm	Firmness 30cm from soil kg/cm^2
Stem plants at length 100 cm from soil	28.79a	83.61b	7.34a	7.82a	109.32a	418.55a	9.59a
Stem plants at length 150 cm from soil	26.46b	82.27a	6.70b	6.20b	101.85b	400.10b	7.96b

Means followed by the same letters are not significantly different.

Table 3.

Effect of depth water on contenting water from visual and chemical characterize in area Ishan Goba for season 2017.

Water contenting	Color PCU	pH	Ec (µs/cm)	Turbidity NTV	T.S.S mg/L	T.D.S mg/L	Soluble CO2 mg/L
Depth 100 cm from surface	5 b	7.24 a	1454 b	2.80 b	84 b	1066 b	20.77 b
Depth 150 cm from surface	9 a	7.61 a	1500 a	5.24 a	104 a	1098 a	29.50 a

Means followed by the same letters are not significantly different.

Table 4.

Effect of depth water on contenting water from visual and chemical characterize in area Ishan Goba for season 2017.

Water contenting	Soluble DO mg/L	Total hardness mg/L	Total alkality mg/L	Cd	Cr	Ni	Co
Depth 100 cm from surface	4.5 b	60-115 b	180.13 b	0.026 a	0.011 b	0.043 b	0.040 b
Depth 150 cm from surface	6.9 a	75-150 a	219.56 a	0.035 a	0.090 a	0.065 a	0.055 a

Means followed by the same letters are not significantly different.

Conclusion

It could be concluded from this experiment that, characterize of vegetative growth on plants Papyrus and Reed i.e leaf area, leaf moisture, number leaves / plant, leaf thickness, number of nods, total chlorophyll and firmness of pulp at plants of stem at length 100 cm from soil more gave the best result compared with plants of stem at length 150 cm from soil and best water quality in decreasing depth from surface water .

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	JIF = 1.500	SJIF (Morocco) = 2.031	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 06.09.2018 **http://T-Science.org**

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MEASUREMENT INDICATORS OF THE LABOR POTENTIAL

Abstract: *The article is devoted to the theoretical foundations of the analysis of the labor potential of workers. Approaches concerning creation of organizational and methodical tools of management of labor potential are presenting. Some procedural features of the system study of the problem of effective use of labor opportunities of workers are shown. The article presents the main results of studies of labor opportunities of workers, including tools that allow to obtain a visual representation of the state of labor potential. The necessity of creation of tools of measurement of labor potential is proved. An approach containing methods for obtaining the concentration of labor potential meters is presented.*

Key words: *labor potential, component, labor sphere, worker, measurement of labor, concentration of labor potential.*

Language: *Russian*

Citation: Radko SG (2018) MEASUREMENT INDICATORS OF THE LABOR POTENTIAL. ISJ Theoretical & Applied Science, 09 (65): 13-20.

Soi: http://s-o-i.org/1.1/TAS-09-65-3 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.3

ПОКАЗАТЕЛИ ИЗМЕРЕНИЯ ТРУДОВОГО ПОТЕНЦИАЛА

Аннотация: *Статья посвящена теоретическим основам анализа трудового потенциала работников. Изложены подходы, касающиеся создания организационно-методического инструментария управления трудовым потенциалом. Показаны отдельные процедурные особенности системного изучения проблемы эффективного использования трудовых возможностей работников. Представлены основные результаты исследований трудовых возможностей работников, включающие инструментарий, позволяющий получать наглядное представление о состоянии трудового потенциала. Обоснована необходимость создания инструментария измерения трудового потенциала. Представлен подход, содержащий способы получения измерителей концентрации трудового потенциала.*

Ключевые слова: *трудовой потенциал, компонент, трудовая сфера, работник, измерение труда, концентрация трудового потенциала.*

Introduction

Одной из проблем, постулируемых в теории труда, является совершенствование управления персоналом при максимально полном использовании способностей работников. Без исследований трудового потенциала сложно осуществить выделение условий для максимально эффективного достижения производственных целей. Способности обычно выступают в качестве трудовых возможностей работников, являющихся значимым средством реализации целей предприятий. В условиях производственной деятельности возникает необходимость сравнения трудовых потенциалов работников. Трудовые потенциалы различаются по числу компонентов, что вызывает трудности в процедурах их сравнения. Чтобы выполнять анализ потенциальных трудовых возможностей, требуется определять показатели, относимые к компонентам. В теории такие показатели называются технико-экономическими показателями трудового потенциала, а их число определяются целями исследования. Сравнение трудовых потенциалов работников с одинаковыми компонентами дает возможность их сопоставлять по качеству. Результаты оценки трудовых потенциалов с различным числом компонентов дают представление о качестве

компонентов при условии выбора наиболее значимых из них. Числовые величины приоритетности по выбранным критериям определяются по выбранным критериям с использованием любого из методов расчета коэффициентов важности.

Materials and Methods

Трудовой потенциал определяет возможности конкретного работника и трудовых коллективов выполнять поставленные перед ними задачи [1; 2]. Работник при выполнении трудовой деятельности использует разнообразные личностные качества, к которым обычно относятся знания, умения, профессиональные навыки, психологические особенности и т.д. Трудовой потенциал обычно разделяется на профессионально-квалификационный и личностный. Профессионально-квалификационные качества приобретаются в процессе учебы и при постепенном получении опыта, личностные характеристики даются от природы. Поэтому трудовой потенциал имеет сложную структуру, включающую совокупность групп различных компонентов, определяющих трудоспособность работника.

Компоненты трудового потенциала удобно классифицировать по различным группам. К основным из них относятся психофизиологические, квалификационные и личностные. Психофизиологические отражают наклонности человека, здоровье, талант и т.д. Квалификационные включают знания и умения, получаемые в процессе приобретения профессионально-квалификационных навыков. Личностные, не связанные напрямую с трудовой деятельностью, характеризуют человека как развитую личность, включая любознательность, мобильность, одухотворенность, и т.д. Разнообразные особенности потенциала работников служили объектом исследования на протяжении многих десятилетий, что отображено в [5; 6; 7; 10]

На основании исследований трудового потенциала, выполненных в Российском государственном университете им. А.Н. Косыгина (Технологии. Дизайн. Искусство), сформулированы основные положения теории трудового потенциала и определены относящиеся к нему проблемы.

1. Отсутствует согласованное учеными и практиками определение трудового потенциала. В различных публикациях, затрагивающих проблемные вопросы труда, авторами используется несогласованная терминология, что может приводить к противоречиям в описании трудового потенциала.

2. Отсутствует обязательный перечень компонентов трудового потенциала, на основании которого возможно получать ясное представление о внутреннем содержании его структуры.

3. Инструментарий измерения трудового потенциала находится в стадии развития.

Рассматривая данные проблемы, можно заметить, что они взаимосвязаны. При отсутствии понятного и общепринятого определения трудового потенциала естественным образом возникают затруднения при описании структуры. Наличие представления о структуре любой социально-экономической категории, особенно такой, как трудовой потенциал, является обязательным условием разработки инструментария анализа.

Вопрос об определении трудового потенциала является дискуссионным. Примем, что трудовой потенциал выступает в качестве средств и возможностей, используемых для достижения поставленных субъектами хозяйственной деятельности (группами работников и в целом коллективами) целей. Для трудового потенциала коллектива (предприятия, организации) в [5; 6] приведено следующее определение.

Трудовой потенциал представляет собой **основанную на профессиональных знаниях, практических навыках, личностных и психофизиологических характеристиках способность работников реализовывать цели предприятия при надлежащем материально-техническом, информационном и организационном обеспечении процесса труда.**

Данное определение получило распространение и показало удобство в применении. Например, его целесообразно использовать с точки зрения представления структуры трудового потенциала. В практических целях возможно использовать более сокращенный вариант определения.

Трудовой потенциал представляет собой **способность работников реализовывать цели предприятия при надлежащем материально-техническом, информационном и организационном обеспечении процесса труда.**

В содержательной форме определение показывает, что включается в трудовой потенциал. Поэтому оно является оптимальным для представления содержания трудового потенциала и в достаточной мере информативно. Из определения видно, какие характеристики работников выступают в качестве основы для реализации трудовых задач. Для получения более полного представления о трудовом потенциале следует обратиться к понятию его структуры.

Структура трудового потенциала – соотношение компонентов, отражающих

профессиональные знания, практические навыки, личностные и психофизиологические характеристики, относящиеся к способностям людей в сфере трудовой деятельности.

Измерение трудового потенциала возможно только при наличии технико-экономических показателей. Под технико-экономическими показателями трудового потенциала понимается система взаимосвязанных и взаимосогласованных показателей, характеризующих количественные и качественные особенности компонентов трудового потенциала и дающих возможность получать представление о трудовых возможностях работников.

Процесс производства определяется множеством конкретных условий и особенностей, зависящих от специфики предприятия. Для руководителей требуется выполнять эффективную производственную политику, что подразумевает координацию действий руководящего звена с учетом возможностей кадрового состава. Поэтому приоритетными целями исследований трудового потенциала являются:

1) **развитие теории трудового потенциала с целью выработки устойчивой системы относящихся к нему понятий и определений;**

2) **разработка экономико-математического инструментария анализа и оценки трудового потенциала.**

Отдельно остановимся на такой категории, как конкурентоспособность работников. Данное понятие вбирает в себя множество составляющих и показывает возможности работников получать наилучшие позиции в конкурентной борьбе. Для понимания конкурентоспособности как чего-то, требуемого носителю трудового потенциала, интерес представляют конкретизированные в знаниях, умениях и навыках способности работников выполнять эффективную трудовую деятельность. Здесь возникает необходимость сформулировать определение конкурентоспособности, содержательно связанное с трудовым потенциалом. Термин «конкурентоспособность работника» использовалось и исследовалось на протяжении долгого периода, так как для любого исторического периода времени она является существенной на рынке труда. Рассматривая конкурентные преимущества применительно к трудовому потенциалу, следует обратить внимание на то, что возможности работников на рынке труда можно определить исходя из сложившегося на сегодняшний день понимания содержания трудового потенциала [3; 4; 5].

С учетом определения трудового потенциала под **уровнем конкурентоспособности** работника следует понимать **степень соответствия психофизиологических, личностных и профессионально-квалификационных характеристик требованиям работодателя в определенной сфере труда**. Уровень конкурентоспособности в любой момент времени может соответствовать или не соответствовать предпочтениям работодателя и требованиям, определяемым содержанием труда. Здесь представлено определение конкурентоспособности, опирающееся на понимание трудового потенциала как сложного социально-экономического образования. Основываясь на понимании трудового потенциала, формулируется понимание конкурентных преимуществ применительно к отдельному работнику.

Конкурентные преимущества – психофизиологические, личностные и профессионально-квалификационные характеристики, в определенных условиях места и времени соответствующие требованиям работодателя в наибольшей степени по критерию результативности трудовой деятельности. Требования работодателя определяются содержанием труда на конкретном рабочем месте и пониманием им конкурентных преимуществ работника, позволяющих ему занимать конкретное рабочее место.

В производственной деятельности однозначных решений, касающихся кадрового состава, принимать трудно. Результативность кадровых решений часто определяется опытом и интуицией руководителя. Для практических целей удобно использовать модели, отражающие реально протекающие кадровые процессы и представляющие в наглядной форме особенности трудового потенциала как сложно организованного социально-экономического образования. В таких моделях требуется учитывать содержание процесса управления персоналом с учетом всего многообразия качеств работников, включаемых в трудовой потенциал. Представление о качестве управления кадрами и степени развития трудового потенциала может быть получено в результате оценки потенциалов работников и их сопоставления. Поэтому возникает задача измерения трудового потенциала.

Основной целью исследования потенциальных трудовых возможностей является развитие существующих на сегодняшний день методов управления кадрами и создание экономико-математического инструментария измерения трудового потенциала. Эффективность процедур сопоставления потенциалов повысит наличие качественного инструментария измерения. Результативность подобного экономико-математического инструментария

будет определяться его применимостью для различных сфер человеческой деятельности. Сложности проявляются в попытках привести к единому знаменателю всю совокупность компонентов и отражающих их технико-экономических показателей. При измерении трудового потенциала требуется описывать механизм его использования, что позволяет оценивать влияние личностных характеристик работников на итог трудовой деятельности. Трудовой потенциал, являющийся социально-экономическим образованием, состоит из компонентов, различающихся принципиально. Поэтому инструментарий требуется подбирать такой, который позволял бы сопоставлять разнородные личностные характеристики работников. Теоретические основы анализа трудового потенциала, отражающие существующие на сегодня инструментальные средства и возможности его оценки, изложены в [5, 6]. Здесь отметим возможности функционально-стоимостного анализа, позволяющего гибко сопоставлять компоненты по их функциям, находящим свое отражение в производственной деятельности. Подход на основании использования функционально-стоимостного анализа позволяет максимально полно учитывать личностные и профессионально-квалификационные характеристики работников, являющиеся компонентами.

Решение сопряженных с трудовым потенциалом производственных задач осложняется структурой совокупного потенциала работников, содержащего множество составляющих и трудно определяемых взаимосвязей. Каждый элемент структуры вбирает в себя множество особенностей людей, проявляющиеся в сфере трудовой деятельности. Таким образом, в кадровой сфере следует вырабатывать унифицированную терминологию, приемлемую для практики управления персоналом и развития трудового потенциала [8; 9; 10].

Так как руководящему составу приходится оценивать соответствие затрат на развитие трудового потенциала ожидаемым результатам, требуется система измерителей трудового потенциала. Получить такую систему трудно без представления о содержании и особенностях потенциала работников. Система измерителей должна позволять получать адекватное отображение значимых компонентов и давать представление о качестве трудового потенциала в выбранный момент времени. Для этого необходимо создание методов, позволяющих свойства и особенности трудового потенциала сводить к единой численной оценке. В отношении индивидуальных характеристик работников, являющихся компонентам, удобно использовать термин «состояние». Состояние трудового потенциала выступает в качестве индикатора уровня его развития и характеризуется совокупностью значений технико-экономических показателей компонентов, зафиксированных на определенный момент времени. Конкретизировать результаты оценки состояния трудового потенциала позволяет категория «концентрация», широко используемая в теории отраслевых рынков. Наличие инструментария для измерения концентрации позволяет выполнять измерение состояния трудового потенциала. Конечная цель создания измерителей концентрации трудового потенциала заключается в получении инструмента для наглядного представления о состоянии трудового потенциала, требуемого для принятия эффективных решений в сфере управления кадрами.

Под **концентрацией** трудового потенциала понимаем **сосредоточение профессиональных знаний, практических навыков, личностных и психофизиологических характеристик работников, способных реализовывать цели предприятия**. Потенциал является отражением работника, поэтому исходным отправным пунктом анализа является наличие совокупности работников, или сосредоточение персонала в определенном производственном подразделении. При оптимальном сосредоточении работников на конкретные должности подбираются специалисты, наиболее эффективно выполняющие свои трудовые обязанности. Требуемое для субъекта хозяйственной деятельности сосредоточение работников реализуется при:

- оптимальном сочетании работников, обладающих трудовым потенциалом, требуемым для реализации существующих профессиональных задач;
- результативностью управления, выражаемой единым контекстом знаний, умений и навыков, приоритетных для трудового процесса в конкретных условиях места и времени.

Концентрация представляет собой процесс, поэтому наиболее явным признаком оптимального сосредоточения работников является их трудовая деятельность. Концентрацию трудового потенциала можно определить как сосредоточение требуемого набора компонентов у одного работника или трудового коллектива.

В экономическом анализе концентрация обычно подразделяется на абсолютную и относительную. Каждая из них имеет свои особенности, требующие учета при измерении трудового потенциала. Отличительные признаки концентрации и их значимость для анализа

определяются целями производственной деятельности. Для абсолютной концентрации признаком концентрации является число работников, трудовой потенциал которых исследуется, и числом компонентов, включенных в анализ. Для наиболее простого выражения оптимального подбора работников на протяжении десятилетий использовалась их численность, что в условиях быстрого технологического развития общества теряет актуальность. Поэтому абсолютная концентрация для трудового потенциала как сложного социально-экономического образования большого теоретического интереса не представляет. Но если требуется упрощенный анализ трудовых возможностей работников, возможно к ней обратиться. Признаками абсолютной концентрации также могут выступать рост числа работников, обладающих существенными для предприятия профессионально-квалификационными характеристиками. Для оценки динамики изменения трудового потенциала удобно использовать увеличение доли квалифицированных работников в общей их численности. Признаком относительной концентрации является неравенство трудовых потенциалов (работников или их групп), выраженных в относительной форме. При оценке относительной концентрации выполняется сопоставление распределения компонентов по признаку изменения технико-экономического показателя компонента (уменьшения или увеличения). Возможно использовать распределение компонентов по признаку их значимости для предприятия или рассматривать динамику их изменения по выбранному технико-экономическому показателю. В ряде случаев удобно использовать изменение компонентов в динамике относительно выбранной цели. Для этого компоненты распределяются таким образом, чтобы они были сориентированы относительно выбранного критерия, а их положительное или отрицательное изменение отразит динамику изменения.

Для измерения относительной концентрации приемлемы различные показатели, распределение которых может оцениваться по признаку абсолютной или относительной концентрации. При выполнении экономико-математических исследований в экономике труда обычно выделяется показатель (критерий), максимально значимый для предприятия. В отношении такого показателя в теории трудового потенциала следует использовать термин «основной показатель», что подчеркивает его значение. В процедурах оценки концентрации трудового потенциала приняты соответствующие обозначения:

$$d_i = \frac{x_i}{\sum_{i=1}^{n} x_i}; \sum_{i=1}^{n} d_i = 1 \quad (1)$$

где: $x_i > 0$ – множество значений технико-экономического показателя X, относимых к выделенному компоненту при $i = \overline{1, n}$.

Сумма d_i равно 1, при этом через d_i обозначено множество долей технико-экономического показателя. Значение относительного показателя определяется только распределением x_i. Относительная концентрация показывает неравенство размеров объектов исследуемой совокупности. Такая концентрация может служить критерием отклонения распределения компонентов от:

1) равномерного, не означающего низкой концентрации, а являющегося теоретической точкой отсчета, значение которой зависит от исходных целей управления трудовым потенциалом и приоритетных целей предприятия;

2) минимального, являющего нежелательным (выступающего в качестве негативного критерия);

3) максимального, являющего оптимальным или желательным.

При относительном представлении концентрация изменяется в зависимости от того, каким образом меняется качество индивидуального трудового потенциала работников, что в первую очередь выражается значениями показателей компонентов.

Влияние изменения численности на концентрацию требует отдельного рассмотрения. Показатель абсолютной концентрации M_a представляет собой непрерывную функцию от показателя компонентов при его измерении в абсолютных величинах: $M_a = f(x_i)$ при $x_i > 0$. При рассмотрении содержания концентрации трудового потенциала выводятся основные требования к показателю относительной M_o концентрации, позволяющие интерпретировать результаты измерения трудового потенциала. Это означает, что показатель относительной концентрации представляет собой непрерывную функцию от показателя компонента X: $M_o = f(x_i)$ при $x_i \in [0; 1]$. Показатель относительной концентрации зависит от распределения компонентов по их выделенным группам.

Показатели, используемые для представления компонентов, обычно имеют различные, нередко не сопоставляемые шкалы измерения. Поэтому приведение компонентов к общему измерителю является необходимой и

важной частью процесса создания инструментария анализа трудового потенциала. При оценке относительной концентрации можно выполнять оценку распределений компонентов, различающих по выбранным признакам. Рассмотрим распределение компонентов по признаку изменения показателя компонента и отрицательно или положительно ориентированных относительно главной цели предприятия компонентов. При использовании на практике данного подхода в единый блок анализа следует включать только компоненты, изменение показателей которых однонаправлено и соответствует цели предприятия. Это означает, что одновременное увеличение или уменьшение значений показателей должно свидетельствовать о положительной (для реализации конечных целей) или отрицательной динамике. Затруднение при таком подходе вызывает необходимость объединения компонентов в группы по признаку соответствия их динамики приближению к (удалению от) выбранного критерия.

Выбор оптимального измерителя зависит от конечных целей измерения и наличия информации по компонентам. Так как показатели компонентов могут быть разными, выбор технико-экономических показателей определяет и особенности расчета соответствующего показателя концентрации. При измерении концентрации трудового потенциала следует использовать показатели наиболее значимых компонентов трудового потенциала. В противном случае теряется смысл анализа. Но это означает, что компоненты должны быть выбраны таким образом, чтобы они отражали конкретный трудовой потенциал в степени, требуемой для целей исследования. С использованием разнообразных кадровых методик удобно диагностировать степень устойчивости функционирования и развития предприятия в сфере управления кадрами, что особенно актуально для неустойчивой рыночной среды. Подобный анализ целесообразно выполнять на базе сопоставления технико-экономических показателей, касающихся развития как предприятия, так и кадровой сферы. При этом важно учитывать степень влияния кадровых рисков, сопутствующих принятию управленческих решений. Ранжирование показателей и их сопоставление с уровнями кадровых рисков целесообразно выполнять при выделении сфер кадровой деятельности, способствующих соблюдению оптимального направления развития предприятий.

Необходимыми условиями для выбранного показателя концентрации являются следующие:

- технико-экономический показатель, характеризующий состояние трудового потенциал, должен получать соответствующие единицы измерения и адекватное отображение в выбранной совокупности компонентов;
- должна существовать взаимосвязь (выраженная логически или математически) между показателями измерения трудового потенциала и эффективностью производственной деятельности.

Отдельной и до сих пор до конца не решенной проблемой является отсутствие подхода, позволяющего соотносить доходность компонентов и состояние трудового потенциала. Здесь может быть использован подход на основе использования кривой Лоренца. Для оценки состояния трудового потенциала и в качестве инструментария анализа удобно воспользоваться математическими свойствами и графическим отображением кривой Лоренца. Показателем неравномерности служит отклонение кривой от диагонали, показывающей вариант полного равенства компонентов по критерию получению дохода. Параметрическое представление кривой Лоренца, характеризующее плотность распределения вероятности случайной величины, выглядит классически. Доходность компонентов рассматривается как реализация непрерывной случайной переменной X ($x_i > 0$) с областью определения $a \le X \le b$. В пределах изменения переменной элементы x_i ранжированы в возрастающем порядке. Кривая Лоренца R(K) отражает зависимость между компонентами и показателем доходности (например, рентабельностью труда) и задается в прямоугольной системе координат значениями функций K(x) и R(x) соответствующими значениям x_i. Значения функции K(x) представляют собой кумулированные относительные частоты (относительные ранги) компонентов трудового потенциала. Ранги ранжированы по признаку увеличения показателя рентабельности труда, R(x) показывает кумулированные значения показателя рентабельности труда. Таким образом, процедура ранжирования является обязательной частью анализа.

Определение относительной концентрации трудового потенциала с использованием кривой Лоренца основывается на следующем ее свойстве. При равных размерах исследуемых объектов все точки с координатами K(x), R(x) лежат на биссектрисе координатного угла. Тогда оценка неравенства распределения компонентов выполняется в сравнении с гипотетическим равномерным распределением и, таким образом, результат оценки представляет собой меру относительной концентрации. Биссектриса координатного угла является линией абсолютного равенства (в теории известного как равномерное распределение). При увеличении

разницы между компонентами по критерию дохода, отраженного рентабельностью труда, линия Лоренца все больше отклоняется от равномерного распределения (биссектрисы).

Отклонения характеризуются расстоянием от кривой Лоренца до линии равенства, длиной линии Лоренца, а также площадью, ограниченной кривой Лоренца и линией равенства (A_1).

Пример кривой Лоренца и кривой Лоренца для компонента, отображающего доходность и имеющего равномерное распределение, представлен на рис. 1.

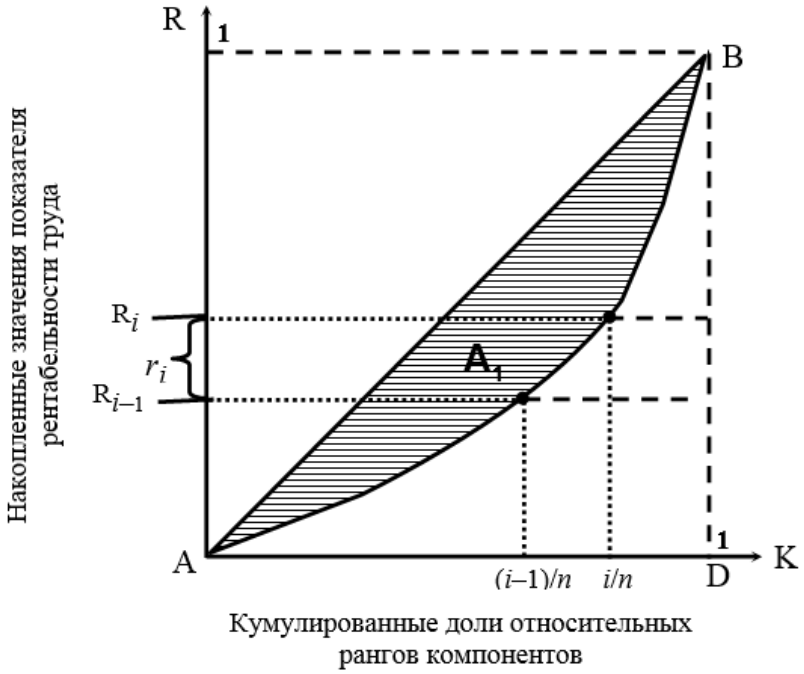

Рисунок 1 – Кривые Лоренца

Для анализа концентрации трудового потенциала следует учитывать свойства кривой Лоренца.

1. Функция K(x) ограничена на интервале $[0,1]$, или $0 \le K(x) \le 1$.

2. Функция R(x) ограничена на интервале $[0,1]$, или $0 \le R(x) \le 1$.

3. Кривая Лоренца начинается и заканчивается на биссектрисе координатного угла, или R(0) = 0 и R(1) = 1.

При дискретном распределении кривая Лоренца характеризуется координатами точек, относимых к расположенным по оси абсцисс компонентам. Значения показателя рентабельности труда нормируются в интервале $]0,1[$. Обозначим через «z» число компонентов из всей их возможной совокупности, по которым выполняется оценка доходности. По полученным нормированным значениям доходности определяются координаты точек следующим образом:

$$K(x_i) = i / n; \quad R(x_i) = R_i = \sum_{z=1}^{n} R_z , \qquad (2)$$

где i – ранг компонентов, расположенных в порядке возрастания величины показателя рентабельности труда ($i = \overline{1, n}$);

R_z – доходность z-го компонента ($z = \overline{1, n}$).

Прямая АВ (линия абсолютного равенства), являясь биссектрисой координатного угла, отражает ситуацию, при которой все компоненты имеют равномерное распределение. При равномерном распределении на каждый компонент из всей их совокупности приходится одинаковая доля основного показателя от его общего объема, что трактуется как абсолютное равенство распределения доходности по выбранной совокупности компонентов трудового потенциала. Фактическая кривая выгнута вниз, так как вдоль оси абсцисс компоненты ранжированы от меньшей к большей. Чем больше различия в значениях показателя рентабельности

труда, тем больше кривая Лоренца отстоит от диагонали АВ.

Измеритель концентрации должен учитывать все точки кривой Лоренца. Непрерывное распределение можно заменить на дискретное. Тогда кривая Лоренца будет задаваться координатами точек, относящихся к выбранным компонентам. Признаки равенства можно установить путем выбора целесообразного технико-экономического показателя. Абсолютное неравенство показывает, что из всей совокупности компонентов только один из них полностью приносится доход. На практике это означает, что какое-либо качество работников в степени, приближенной к максимальной, позволяет получать доход субъекту хозяйственной деятельности. Абсолютное равенство и абсолютное неравенство служат теоретической точкой отсчета для измерения концентрации.

Сравнение разнообразных показателей измерения трудового потенциала в процедурах экономического анализа позволило сделать вывод, что относительная концентрация дает возможность осуществлять оценку любых компонентов. Выбор показателей определяется возможностью их соотнесения на текущий момент времени с оптимальным (идеальным) состоянием трудового потенциала и их приоритетностью с точки зрения реализации целей предприятия. В качестве основных компонентов могут выступать образование, профессиональный опыт, трудовой стаж, аналитический склад ума, психологические особенности, удовлетворенность работой и т.д. Каждый из данных компонентов, имея соответствующий измеритель, может соотноситься с эффективностью деятельности предприятия.

Conclusion

Рассмотренный подход показывает возможности экономико-математического аппарата при выработке инструментария измерения трудового потенциала. Сложности в создании показателей измерения трудового потенциала проявляются в необходимости владения комплексным математическим инструментарием, что означает наличие выраженного междисциплинарного подхода. Использование различных методов и подходов для создания разнообразного и оптимального инструментария анализа и оценки трудового потенциала является необходимым и значимым элементом процесса развития теории трудового потенциала

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Impact Factor:	ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
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	JIF = 1.500	SJIF (Morocco) = 2.031	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 07.09.2018 **http://T-Science.org**

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SECTION 29. Literature. Folklore. Translation Studies.

VENAL LOVE OF THE WOMEN CHARACTERS OF F. S. FITZGERALD'S NOVEL "THE GREAT GATSBY" AND G. DJAVID'S PLAY "SHEYDA"

Abstract: *In this article the comparative analysis of the two works of art written by the famous authors of the XX century is clearly described. The analysis includes the similarities of the qualities inherent to the works' main women characters, Daisy and Rose. The personality of the figures is greedy for money: they are depicted as silly, greedy and venal types, ready to do everything to achieve their goal – prosperity.*

Key words: *Comparative analysis, women characters, similarities, greedy, venal types, prosperity.*

Language: *English*

Citation: Adigezalova MN, Adigezalova MN (2018) VENAL LOVE OF THE WOMEN CHARACTERS OF F. S. FITZGERALD'S NOVEL "THE GREAT GATSBY" AND G. DJAVID'S PLAY "SHEYDA".. ISJ Theoretical & Applied Science, 09 (65): 21-24.

Soi: http://s-o-i.org/1.1/TAS-09-65-4 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.4

Introduction

The XX century is a significant period not only in economic and social spheres, but also in cultural and spiritual ones. In the period American literature came out to a new level, there appeared a tendency of modernism and in Azerbaijan, such tendencies as critical realism and progressive romanticism were thriving. During the period there appeared interesting conceptions and distinctive literary approaches both in world literature, and in Azerbaijani one. Literature of that time, having passed its successful stage of development, was combined in the same way. Integration into the world literature, synthesis with the world literature, attempts to create national literature in the course of the world literature were among the basic principles of the literature of that period. At the end of the XIX century and the beginning of the XX century Nakhichevan made its great contribution to Azerbaijani science and enlightenment. The movement of national enlightenment, having appeared in Azerbaijan, began to appear in Nakhichevan, the representative of which was Guseyn Djavid.

Nakhichevan was one of the centres of ancient Azerbaijani culture. On this land of eminent poets, writers, figures of science and culture there was formed an extremely rich literary milieu. In the literary works of that period the traces of history, art, psychology, pedagogy, geography, political science, linguistics and other sciences.

Socio-economic, socio-cultural innovations paved the way for forming a progressive democratic professional classes. Because of new-leveled hearths of culture and enlightenment social sciences began to be taught, the number of teachers and pupils began to rise. While the tendency towards western literature was increasing, there remained respect to eastern one. In the creative works of every person who was brought up in Nakhichevan literary milieu of masters eastern motive was reflected in original form. Local organs of tsarist government in Southern Caucasus equally with a number the region's branches planned to open uyezd schools of new type at the end of the XIX century and the beginning of the XX century in such cities as Nakhichevan and Ordubad, however, by a number of reasons, especially because of the absence of teaching personnel, they could not realize this project. [1, p.4] Azerbaijani literature, educational system, which were influenced by particular forces for a long time, could not escape strokes. In spite of that fact, sensible Azerbaijani intellectuals who struggled against the strokes and prohibitions were constantly fighting for the sake of the future of their nation.

Among the brightest representatives of this epoch, one can name such writers as F. S. Fitzgerald in America and G. Djavid in Azerbaijan. Despite the

fact that the two authors had different personalities and creative works, both of them were against wars, they were hostile to post-war gain, and were critical to the society they lived in.

Materials and Methods

In the two writers' creative works the issues of betrayal and pernicious chase of richness, which comprehended young people of the period, are traced. The American novelist called the epoch as "The Jazz Age". The aesthetics of that time was cardinally different from all the typical things for the society of the period, i.e. from literary, spiritual, ideological norms and notions. "The Jazz Age", as Fitzgerald determined it, included the period of American history, beginning form the end of the World War I to The Great Depression of 1930s. The characteristic feature of the jazz epoch was a special perception of the time, when every single moment was apprehended as eternity. That was the period of refusing the future, and the desire to live and enjoy only present, current moment. "This is an American tragedy, the tragedy of a man spoilt by bourgeois America with its motto: money talks [2, p.203]. Describing the generation of that time, an American critic M. Cowley stated that it belonged to the period of transition of values to permanent values, which would have been created afterwards [2, p. 187]. Throbbing, nervous rhythms of the style reproduced the atmosphere of feverish fun, inherent in the epoch. Turning back to Fitzgerald's fate, it should be mentioned that, having achieved success and having opened a new age, new epoch, new opportunities for the society, he managed to live the life, which was like realization of "American dream" for many people. However, this circumstance didn't make him happy. Having felt insupportance of his own hopes, observing the results and consequences of his works on the way to it, he noticed personal transformation, - a man becomes unable to control himself at the moment, when he is controlled by a dream.

The first decades of the XX century in Azerbaijani literature, like for most peoples of Russian Empire, were a significant period. During the period eminent creators of realistically – romantic works raised literature to the level of the best examples of the world's fictional and cultural thought by means of their masterpieces. A special merit in development of fictional social thought in Azerbaijan belongs to Guseyn Djavid's dramaturgy.

G. Djavid's singularity is reflected in both the plot and the form of his works, and in selection, generalization and conveyance of the material in the form of a poem, figurative system.

It is stated that G. Djavid's creative works represent an organic mixture of traditional and innovatory things, traditions of classical poetry and folklore, combining rhythmical "experiments", and the ones of intonation with new philosophical traditions of western romantic poetry [3, p 6].

Djavid is a poet – innovator. Not only genre form of poetic tragedy and drama, the founder of which in Azerbaijani literature is he, but also his lyric character and poetical organization of the speech and the poetics of his works are innovative. As M.L. Mihaylov stated, "in fiction form constantly depends on content, there can be nothing arbitrary in it" [4, c.253]. The peak of Guseyn Djavid's creative activity began in very troublous, hard times: the years of World War I, revolution, formation, short existence and fall of Azerbaijani Democratic Republic, establishment of the Soviet power in Azerbaijan, the years of post-revolution collapse, new economic policy, collectivization, etc.

The eminent master of his words, Guseyn Djavid, who developed and enriched the best traditions of centuries-old Azerbaijani literature with his creative works, wise philosophical poetry, unique works of dramaturgy made his great contribution to the national idea's thriving in Azerbaijan. As Heydar Aliyev, the prominent statesman of Azerbaijan, national leader stated: G. Djavid rendered his priceless service to Azerbaijani literature, culture in the XX century. He is one of the greatest personalities who raised Azerbaijani people, their culture, literature and science high. His books are the national property of Azerbaijani people. They are a textbook for modern and the following generations. By means of all his creative works and activity G. Djavid had been raising the culture of the people of Azerbaijan, had been striving for their freedom and independence. All of his works had been calling Azerbaijani people to the national liberty, sovereignty. He always lived freely, he was true to his people, loved them immensely, and was a man who served his people excessively [5].

Djavid's dramaturgy is one of the top events not only in Azerbaijani literature. The great humanist, like the best representatives of romanticism in world literature, put global, eternal, problems common to all humankind, the problems, which in 1910-1930s got new comprehension and interpretation. Ecumenical passion on the background of ecumenical cataclysms lay his plays actual sounding in reality. This makes his romanticism close to reality. T. Efendiyev stated quite fairly, that Guseyn Djavid's dramaturgy, with his romantic ideals, was always closely connected with life, and it put the epoch's problems [6, p 61]. It should be added that raising the problems put by the epoch, Djavid touched upon mainly those of them, which being common to all mankind, are always actual. As such common to all humankind theme and an actual problem are exposed in an appropriate form, this dramaturgy becomes extraordinary and significant.

Let's compare the women characters of F. S. Fitzgerald's novel "The Great Gatsby" (Daisy) and G. Djavid's play "Sheyda"(Rose).

Daisy Buchanan opens the gallery of women characters, she is a young "empty" girl, brought up in luxury, without any problems and troubles, surrounded by rich admirers, «gleaming like silver, safe and proud above the hot struggles of the poor» [7, p.229]. Perhaps, she would not pay attention to a handsome officer Gatsby, having known about his poverty. She could not wait for her sweetheart for a long time, and, as the author noticed, she needed «some force – of love, of money, of unquestionable practicality» [7, p.232] – which would be nearby. Nobody considered her feelings. Therefore, when Tom Buchanan offered her his hand, she accepted it. His wealth and social status flattered her vanity.

Having met Gatsby once again and being aware of the extent of his wealth, Daisy began to feel sympathy to this person. As it seemed, she was ready to respond his engrossing love and leave her husband, but she was led only by prudence and pragmatism, not the great feeling. They can hardly call the change of her decisions infirmity. The confidence, sounding in Tom's voice when he spoke about the frailness of Gatsby's status and richness, made an impact on Daisy. She betrayed Gatsby and left him in difficult situation, without any address. Daisy's angelic appearance, as well as her voice full of feeling, is deceptive, in fact she is as indifferent to other people's fates as her husband, Tom. As far as the plot of the novel develops, Daisy has become circumstantially guilty of three people's death, though it does not disturb her luxurious way of life. Here we should pay tribute to the author's skill, because despite Daisy's behavior, many readers sympathize with her, considering her as a positive and naïve character. However, Daisy is not naïve at all, her limitless egoism makes the woman thrifty and unprincipled. Why does Daisy make such an impression upon readers? The answer is that there is logic in every doing and thought of the figure, so skillfully the author reveals the essence of her motivation. Daisy was brought up in splendor, she got used to such a standard of living, the woman was surrounded by people with a particular way of thinking and absorbed everything surrounding her, and thought the same way as those who were around her. Therefore, it is difficult to blame her for being spoilt or having no feelings characteristic of other social layer's representatives, as she simply does not know another life. The readers can even feel pity for this woman. Daisy can be pitied for being unhappy, but she has to accept it in order to keep the usual style of life. One can feel pity being aware of that this character lives pressing her individuality. Putting on the mask of naivety and ignorance, she uses everybody, gaining everything she wants, moreover, she brings her daughter up in the same way: "I hope she'll be a fool — that's the best thing a girl can be in this world, a beautiful little fool." [7, c.37]. Finally it can be a pity for the spiritual poverty of the people who believe that money talks. This feeling of permissiveness completely covered them, and they became inhuman. These people are not able to think about anything and anybody else, except themselves, having lost their spirituality. One cannot but admire the author, who managed to make others feel pity for the character having no sense of pity for anybody or anything.

Fitzgerald emphasizes that Daisy deserves her husband. He reveals the real personality of her type by means of his masterly fictional method, describing all the nuances of her voice. The author puts the meaning of the voice exactly into Gatsby's mouth, as well as into Daisy's temper: in this wonderful, mesmerizing voice, which attracted people with its melodic change and feverish warmth, which sounded like an immortal song for Gatsby, one could hear the clank of money – «that was the inexhaustible charm that rose and fell in it, the jingle of it, the cymbals' song of it» [7, p.190].

The main things in her life are wealth, money, which redeemed Daisy from the punishment for Myrtle Wilson's murder. She is not interested in the fate of Gatsby, for whose sake she had almost left her husband. She is a typical representative of her class; personal prosperity is above all for her.

Another woman character is Rose, who resembles to Daisy in her interests and desires; she is ready for everything for the sake of it. She was born in an artist's family, which could be considered as an opulent one. First, the girl fell in love with one of the editors, Sheyda, who worked with her father, Max Muller. Nevertheless, this love suddenly dies out with appearing of a new figure, who had recently come from Europe, and whose name was Ashraf, the son of printing house's director. Having met him for the first time, Rose's facial expression changed, and the sweetheart noticed it. Soon Medjid Efendi fires Sheyda because of his composition. Together with the job, he missed his beloved, who, having betrayed him, chose the more prosperous gallant. She responded Ashraf's question: "You still love Sheyda, don't you?" with the smile of surprise: "Love? Oh, no! I only commiserate with him the way one commiserates with a lack all" [8, p 249]. Perhaps, that is why the author chose such a fate for the woman character: she died, trying to save her "sweetie" Ashraf. As to Sheyda, he said that Rose was the sense of his life, that he lived for the love's sake, solaced himself with the feelings to this cruel belle. Rose perished Sheyda by her betrayal, and after her death, he goes mad and as a result, he dies.

Conclusion

Taking into consideration the fact that writers are profound psychologists of human souls, and that

authors' personalities are various and original, studying their works leads to new vision of their works. It is evident that both of the works are beyond one's initial compass, as just one of sad stories about lost illusions. The tragedy of the two authors' epochs and special, sick beauty are expressed in them. However, on the background of this period both F. S. Fitzgerald and G. Djavid put common to all humankind problems, actual in any society, in any time. That is why it is difficult to overestimate the contribution made by the works of these eminent writers to American, Azerbaijani and world literature.

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SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 11.09.2018 **http://T-Science.org**

SECTION 7. Mechanics and machine construction.

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RESEARCH OF DEFORMATION OF THE CURRENT CARRYING ORTHOTROPIC SHELLS IN NONLINEAR STATEMENT

Abstract: *In the present paper, the effect of taking into account the nonlinearity in determining the stress-strain state of flexible orthotropic shells in a geometrically nonlinear setting is studied using the example of a flexible current-carrying orthotropic conical shell located in a magnetic field.*

Key words: *shell, magnetic field, magneto elasticity.*

Language: *English*

Citation: Indiaminov R, Butaev R, Mavlanov S (2018) RESEARCH OF DEFORMATION OF THE CURRENT CARRYING ORTHOTROPIC SHELLS IN NONLINEAR STATEMENT. ISJ Theoretical & Applied Science, 09 (65): 25-30.

Soi: http://s-o-i.org/1.1/TAS-09-65-5 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.5

INTRODUCTION

An important place in the mechanics of conjugate fields is occupied by the study of the motion of a continuous medium with allowance for electromagnetic effects. One of the main directions of development of modern solid mechanics is a development of the theory of conjugate fields and, in particular, the theory of the electromagnetic interaction with deformable medium [6, 7, 16, 17, 20]. The electromagnetoelasticity coupled problems of anisotropic plates and shells having anisotropic conductivity are of scientific interest in terms of both theory and applications. The matter is that in the case of thin anisotropic bodies having anisotropic conductivity it is possible to solve optimal problems of magnetoelasticity by the variation of all physical-mechanical material parameters of body.

Most of the known works on the deformation of elastic conducting bodies are performed for a linearized system of equations. However, the solution of a number of applied problems, to which the nonstationary problems of determining the stressed state of flexible current-carrying anisotropic shells should be attributed, requires a more complete study of mechanical processes, including the wave fields accompanying the magnetoelastic interaction, on the basis of the nonlinear model of magnetoelasticity and represent an actual scientific problem. Problems interaction between electro-magnetic field and deformed bodies are frequent in advanced technology.

PROBLEM FORMULATION

Assuming that an external magnetic field acts on the body, the magnetoelasticity equations in the Lagrangian variables in the region occupied by the body (internal problem) can be represented in the form [1-3, 5]:

$$rot\,\vec{E} = -\frac{\partial \vec{B}}{\partial t};\ rot\,\vec{H} = \vec{J} + \vec{J}_{cm};$$

$$div\,\vec{B} = 0,\ div\,\vec{D} = 0; \qquad (1)$$

$$\rho\frac{\partial \vec{\upsilon}}{\partial t} = \rho(\vec{f} + \vec{f}^{\wedge}) + div\hat{\sigma} \qquad (2)$$

where $\vec{E}$ – electric field strength; $\vec{H}$ – magnetic field strength; $\vec{B}$ – magnetic induction; $\vec{D}$ – electrical induction; $\vec{J}_{cm}$ – a density of foreign current, $\vec{f}$ – a volume mechanical force, $\vec{f}^{\wedge}$ – a Lorentz volume force, $\vec{J}$ – a density of current,

$\rho-$ is the density of the material; $\vec{\upsilon}-$ rate of deformation; $\hat{\sigma}$ – an internal stress tensor.

For the case of quadratic nonlinearity considered in [2, 3, 5], we assume that deformations and shifts are small in comparison with the angles of rotation of the element, and the angles themselves are substantially less than unity. Elastic properties of the shell are considered orthotropic, which main directions of elasticity coincide with the directions of the corresponding coordinate lines. Material obeys the generalized Hooke's law and has a finite conductivity. Electromagnetic properties of the material of the current-carrying shell are characterized by tensors of electrical conductivity σ_{ij}, magnetic permeability μ_{ij} and dielectric permittivity $\varepsilon_{ij}\,(i,\ j=1,2,3)$. At the same time due to the crystallophysics for the considered class of conducting media with rhombic crystal structure it was considered that the tensors $\sigma_{ij}, \mu_{ij}, \varepsilon_{ij}$ take a diagonal form [4, 11, 19].

System of equations must be closed magnetoelasticity relations linking the vectors of the electromagnetic field and induction, as well as Ohm's law defining the conduction current density in a movable medium. If the body is linear with respect to the anisotropic magnetic and electrical properties, the constitutive equations for the electromagnetic field characteristics and kinematic equations for the electrical conductivity, as well as expressions for the Lorentz forces, taking into account the external current $\vec{J}_{cm}$ into the Lagrangian variables are written respectively as:

$$\vec{B}=\mu_{ij}\vec{H},\ \vec{D}=\varepsilon_{ij}\vec{E}, \tag{3}$$

$$\vec{J}=\sigma_{ij}\Gamma F^{T}F^{-1}\left[\vec{J}_{cm}+\vec{E}+\vec{\upsilon}\times\vec{B}\right], \tag{4}$$

$$\rho\,\vec{f}^{\wedge}=\Gamma^{-1}F^{-1}\left[\vec{J}_{cm}\times\vec{B}+\sigma_{ij}\left(\vec{E}+\vec{\upsilon}\times\vec{B}\right)\times\vec{B}\right] \tag{5}$$

Here $\sigma_{ij}, \varepsilon_{ij}, \mu_{ij}$ are the tensors of electrical conductivity, dielectric and magnetic permittivities of linear current-carrying anisotropic body $(i,\ j=1,2,3)$ respectively. For homogeneous anisotropic media, they are symmetric second-rank tensors. Thus, equations (1) and (2) together with (3)-(5) are a closed system of nonlinear equations of magnetoelasticity for anisotropic current-carrying bodies with anisotropic electrical conductivity, magnetic and dielectric permittivities in the Lagrangian formulation.

Coordinate surface in the unstrained state we assign to the curvilinear orthogonal coordinate system s and θ, where $s-$ length of the arc forming (meridian) is measured from a fixed point, $\theta-$ central angle in a parallel circle measured from the selected plane. The coordinate lines $s=const$ and $\theta=const$ lines are the principal curvatures of the surface coordinate. Choosing a coordinate ζ coordinate normal to the surface of revolution, we refer to the shell of the spatial coordinate system of coordinates s,θ,ζ. Assume that the surface of the conical shell known magnetic induction, and the surface mechanical strength. Upon receipt of the resolution of the system in the normal form of Cauchy choose as basic functions $u, w, \theta_S, N_S, Q_S, M_S, B_\zeta, E_\theta$.

By selecting these functions in the future, you can choose different combinations of fixing cone. We assume that all the components of the excited electromagnetic field and displacement field belonging to magneto-elasticity problem equation does not depend on the coordinates θ, and also believe that the elastic characteristics and electromagneto-mechanical shell material does not vary along the parallels.

After some transformations [11], we obtain a complete system of nonlinear differential equations in the form magnetoelasticity Cauchy, which describes the stress-strain state of the current-carrying orthotropic conical shell with an unsteady mechanical and magnetic fields:

$$\begin{aligned}
&\frac{\partial u}{\partial s}=\frac{1-\nu_s\nu_\theta}{e_s h}N_S-\frac{\nu_\theta\cos\varphi}{r}u-\\
&-\frac{\nu_\theta\sin\varphi}{r}w-\frac{1}{2}\theta_S^2;\ \frac{\partial w}{\partial s}=-\theta_S;\\
&\frac{\partial\theta_S}{\partial s}=\frac{12(1-\nu_s\nu_\theta)}{e_s h^3}M_S-\\
&-\frac{\nu_\theta\cos\varphi}{r}\theta_S;\\
&\frac{\partial N_S}{\partial s}=\frac{\cos\varphi}{r}\left(\left(\nu_S\frac{e_\theta}{e_S}-1\right)N_S+\right.\\
&\left.+e_\theta h\left(\frac{\cos\varphi}{r}u+\frac{\sin\varphi}{r}w\right)\right)-\\
&-P_S+h\,J_{\theta CT}B_\zeta-\sigma_1 h\left[E_\theta B_\zeta+\right.\\
&\left.0.5\frac{\partial w}{\partial t}B_\zeta\left(B_S^{+}+B_S^{-}\right)-\frac{\partial u}{\partial t}B_\zeta^2\right]+\rho h\frac{\partial^2 u}{\partial t^2};\\
&\frac{\partial Q_S}{\partial s}=-\frac{\cos\varphi}{r}Q_S+\nu_S\frac{e_\theta}{e_S}\frac{\sin\varphi}{r}N_S+\\
&+e_\theta h\frac{\sin\varphi}{r}\left(\frac{\cos\varphi}{r}u+\frac{\sin\varphi}{r}w\right)-P_\zeta-\\
&-0.5h\,J_{\theta CT}\left(B_S^{+}+B_S^{-}\right)-\sigma_3 h\left[-0.5\,E_\theta\left(B_S^{+}+B_S^{-}\right)-\right.\\
&\left.-0.25\,\frac{\partial w}{\partial t}\left(B_S^{+}+B_S^{-}\right)^2-\right.
\end{aligned} \tag{6}$$

$$-\frac{1}{12}\frac{\partial w}{\partial t}\left(B_S^+ - B_S^-\right)^2 + 0.5\frac{\partial u}{\partial t}B_\zeta\left(B_S^+ + B_S^-\right) +$$

$$+\frac{h}{12}\frac{\partial \theta_S}{\partial t}B_\zeta\left(B_S^+ + B_S^-\right)] + \rho h\frac{\partial^2 w}{\partial t^2};$$

$$\frac{\partial M_S}{\partial s} = \frac{\cos\varphi}{r}\left[\left(\nu_S\frac{e_\theta}{e_S} - 1\right)M_S + \right.$$

$$\left. + \frac{e_\theta h^3}{12}\frac{\cos\varphi}{r}\theta_S\right] + Q_S + N_S\theta_S -$$

$$-\frac{\sin\varphi}{r}\left(\nu_S\frac{e_\theta}{e_S}M_S + \frac{e_\theta h^3}{12}\frac{\cos\varphi}{r}\theta_S\right)\theta_S +$$

$$+\frac{h^3}{12}\frac{\partial^2\theta_S}{\partial t^2};$$

$$\frac{\partial B_\zeta}{\partial s} = -\sigma_2\mu\left[E_\theta + 0.5\frac{\partial w}{\partial t}\left(B_S^+ + B_S^-\right) - \frac{\partial u}{\partial t}B_\zeta\right] +$$

$$+\frac{B_S^+ - B_S^-}{h};$$

$$\frac{\partial E_\theta}{\partial s} = -\frac{\partial B_\zeta}{\partial t} - \frac{\cos\varphi}{r}E_\theta.$$

Here N_s, $N_\theta -$ meridional and circumferential forces; $S -$ shear; $Q_s, -$ shear force; $M_s, M_\theta -$ bending moments; u, $w -$ displacement and deflection; $\theta_S -$ the rotation angle of the normal; $P_S, P_\zeta -$ mechanical load components; $E_\theta -$ mechanical load components; B_ζ – the normal component of the magnetic induction; $B_s^+, B_s^- -$ known components of the magnetic induction on the surface of the shell; $J_{\theta cm} -$ component of the electric current density from an external source; $e_s, e_\theta -$ elastic modules in the directions $s, \theta -$ respectively; $\nu_S, \nu_\theta -$ Poisson's ratio, which characterize the tensile transverse compression in the direction of the coordinate axes; $\mu -$ permeability; $\omega -$ the angular frequency; $\sigma_1, \sigma_2, \sigma_3$ – the main components of the tensor conductivity.

Obtained coupled allowing system of nonlinear differential equations of order eight (6) describes the stress-strain state of flexible current-carrying orthotropic conical shells of rotation having orthotropic electrical conductivity, magnetic and electrical permittivity. Solving of magnetoelasticity boundary values problems associated with the essential computational difficulties.

This is because the resolution of the system of equations (6) is a system of differential equations of hyperbolic-parabolic type of eighth-order with variable coefficients. Components of the Lorentz force consider the speed of shell deformation, an external magnetic field, the size and intensity of the conduction current relatively to the external magnetic field. Accounting for nonlinearity in the equations of motion causes nonlinearity in the ponderomotive force. The boundary conditions for the functions characterizing the mechanical part of the problem are as in the usual theory of shells. The boundary conditions for electromagnetic functions can be specified taking into account the electric field or a combination of electrical and magnetic fields. The initial conditions are given in the classical form.

METHODOLOGY OF THE SOLUTION

The method for solving the nonlinear problem of the magnetoelasticity of shells is based on the consistent use of the Newmark scheme, the quasilinearization method, and the discrete orthogonalization method [3, 8-15, 18]. To separate the variables from the time coordinate, we apply the implicit Newmark scheme, with which the nonlinear boundary value problem reduces to a sequence of nonlinear one-dimensional boundary value problems at each time step. The next step in solving the sequence of nonlinear boundary value problems of magnetoelasticity is based on the application of the quasilinearization method, with which the nonlinear boundary value problem reduces to a sequence of linear boundary value problems. Then each of the linear boundary value problems of the sequence on the corresponding time interval is solved numerically with the help of the stable method of discrete orthogonalization.

THE DISCUSSION OF THE RESULTS

A study of the stress-strain state of flexible orthotropic conical shell of boroaluminum of constant thickness $h = 5\cdot10^{-4}\,m$, under mechanical stress $P_\zeta = 5\cdot10^3\sin\omega t\ N/m^2$ was performed. The shell is in an external magnetic field $B_{S0} = 0.1T$ and is applied by the external electrical current of $J_{\theta CT} = -5\cdot10^4\sin\omega t\ A/m^2$, density. The shell has a finite orthotropic conductivity $\sigma(\sigma_1, \sigma_2, \sigma_3)$. Note that in this case the anisotropy of specific electrical resistivity is $\eta_3/\eta_1 = 2.27$.

We assume that by the electric current in the disturbed state is evenly distributed on the shell, the external current density does not depend on the coordinates. In this case, the combined effect on the shell loading, the ponderomotive force consisting of Lorentz forces and mechanical.

The boundary conditions are

$s = s_0 = 0 : u = 0, Q_S = -200, M_S = 0, B_\zeta = 0.3\sin\omega t\ T;$

$s = s_N = 0.4m : w = 0, \quad \theta_S = 0, \quad B_\zeta = 0.$

The initial conditions are

$$\vec{N}(s,t)\big|_{t=0}=0,\quad \dot{u}(s,t)\big|_{t=0}=0,\quad \dot{w}(s,t)\big|_{t=0}=0$$

The parameters of the shell and the material are:

$$s_0=0,\ s_N=0{,}4m,\ h=5\cdot10^{-4}m,\ r_0=0.4m$$

$$r=r_0+s\cos\varphi;\ ,\ \omega=314.16\,\sec^{-1},\ \varphi=\pi/15,$$

$$\rho=2300\,kg/m^3,\ B_s^+=B_s^-=0.5\,T.,,$$

$$\mu=1.256\cdot10^{-6}\,H/m,\ J_{\theta cm}=-5\cdot10^5\sin\omega t\,A/m^2,$$

$$\sigma_1=0.454\cdot10^8(\Omega\times m)^{-1},\ \sigma_2=0.454\cdot10^8(\Omega\times m)^{-1},$$

$$\sigma_3=0.200\cdot10^8(\Omega\times m)^{-1},\ \nu_S=0.262,\nu_\theta=0.320,$$

$$P_\varsigma=5\cdot10^3\sin\omega t\,N/m^2,\ B_{S0}=0.1\,T$$

$$e_S=22.9\cdot10^{10}N/m^2,\ e_\theta=10.7\cdot10^{10}N/m^2$$

The solution is found in the time interval $\tau=0\div10^{-2}\sec$ for the integration time step is chosen to be $\Delta t=1\cdot10^{-3}\sec$. Maximum values obtained at time step $t=5\cdot10^{-3}\sec$.

It was investigated the stress-strain states of flexible shells in nonlinear formulation based on comparison of the solutions obtained for the current-carrying orthotropic cone of beryllium and current-carrying isotropic cone of aluminum, as well as for the isotropic cone of aluminum in the absence of a magnetic field and the external current.

In Fig. 1 shows the deflection distribution according to "s" at $t=5\cdot10^{-3}\sec$. The results of the calculations are given for the variants: 1 - a current-carrying isotropic cone made of aluminum; 2 is an isotropic cone made of aluminum in the absence of a magnetic field and an external current; 3 - current-carrying orthotropic cone of beryllium. In all three cases the distribution of the deflection is nonlinear ($1\le w/h_0\le5$) and its maximum values occur in the left contour of the shell. Thus, in the case of beryllium orthotropic cone and the cone of isotropic alumina, considering the maximum value of the magnetic field deflection differs by about two times.

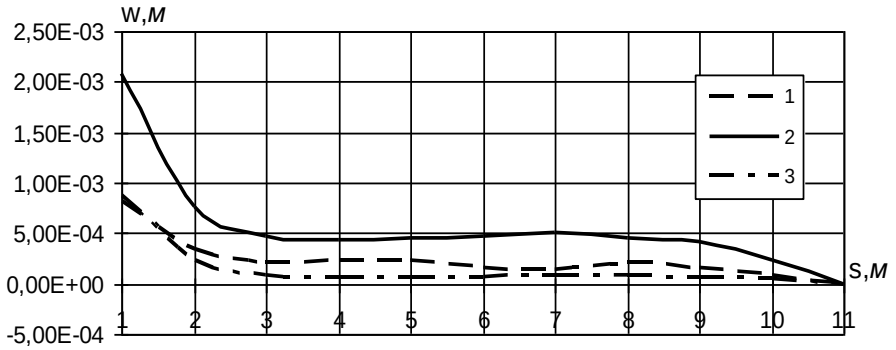

Figure 1 - Distribution deflection $w(s)$ at $t=5\cdot10^{-3}\sec$ for all variants.

It was revealed that in the case of the isotropic cone without influence of the magnetic and electric fields the deflection increases significantly ($w/h_0=4$). This is because in the absence of an electric field acting on the shell the tensile strength of the tangential component of the magnetic induction ($B_s^{\pm}$) and the tangential component of the Lorentz force ($\rho F_S^{\wedge}$) is equals to zero. In this case the shell becomes more ductile, i.e. flexible with respect to the deflectio n. The absence of a magnetic field ($B_\varsigma=0$) also leads to an increase in deflection.

Figures 2 and 3 show the distributions of the maximum stresses $\sigma_{22}^+(s)+T_{22}^+(s)$ and meridional bending moment M_S along the meridian of the shell at the time point $t=5\cdot10^{-3}\sec$ for all variants: 1 - the current-carrying orthotropic cone of beryllium; 2 - current-carrying isotropic cone made of aluminum; 3 is an isotropic cone made of aluminum in the absence of a magnetic field and an external current.

$$\sigma_{22}^+ + T_{22}^+,\ N/m^2$$

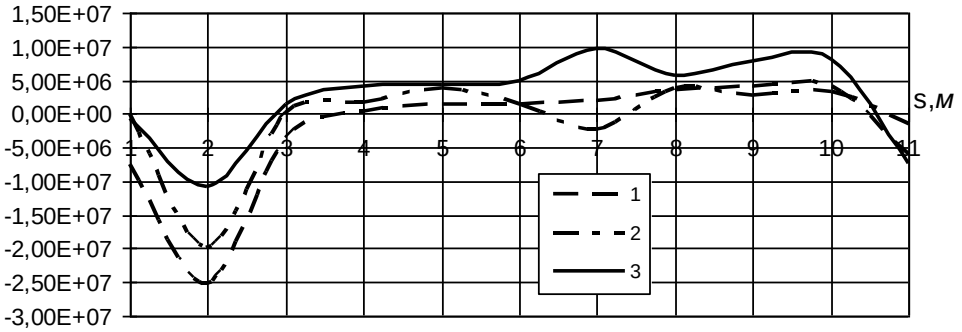

Figure 2 - Distributions of the maximum stresses $\sigma_{22}^{+} + T_{22}^{+}$ at $t = 5 \cdot 10^{-3}$ sec for all variants.

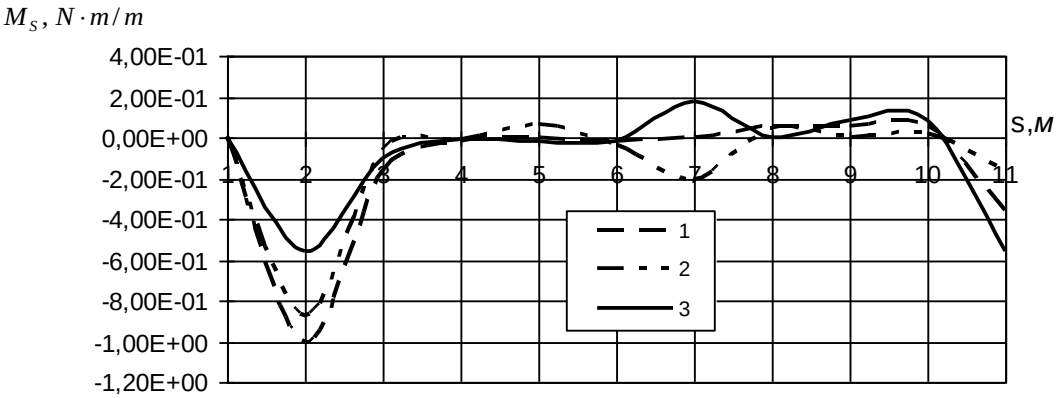

Figure 3 - Distribution meridional bending moment $M(s)$ at $t = 5 \cdot 10^{-3}$ sec for all variants for all variants.

Note that when solving the problem, the stress of the conical shell was considered as the sum of Maxwell's mechanical stresses and stresses, i.e. the total stress state was taken into account. It can be seen from these curves that the distribution of the change in stresses and bending moment differs quantitatively and qualitatively. A phase-independent distribution of stresses and bending moment is observed on a segment 0.08 m <s <0.4 m. Their maximum values arise near the left-hand section of the shell at $s = 0.04m$. In this case, in the presence of a magnetic field and an external current and their absence, the values of stresses and bending moment in differ by 1.5 times. The obtained results show the influence of orthotropic electrical conductivity, external electric current and external magnetic field on the stress-strain state of the shell, and the inclusion of geometric nonlinearity makes it possible to substantially clarify the deformation picture.

CONCLUSION

The nonlinear problem of magnetoelasticity is considered in the axisymmetric statement for conical shells. The resolving system of nonlinear differential equations is obtained, which describes the stress-strain state of the flexible orthotropic conical shell in mechanical and magnetic fields. The numerical example is given. The stress-strain state of flexible shells in nonlinear formulation based on comparison of the solutions obtained for the current-carrying orthotropic cone of beryllium and current-carrying isotropic cone of aluminum, as well as for the isotropic cone of aluminum in the absence of a magnetic field and the external current was investigated. In all three cases the distribution of the non-linear deflection and its maximum values occur in the left contour of the shell. At the same time in the case of beryllium orthotropic cone and the isotropic cone of aluminum, considering the magnetic field maximum values of deflection differ by about two times. It was revealed that in the case of the isotropic cone without influence of the magnetic and electric fields, the deflection increases significantly. This is because in the absence of an electric field acting on the shell, the tensile strength of the tangential component of the magnetic induction, and the tangential component of the Lorentz force equals to zero.

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Impact Factor:	ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
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	GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 11.09.2018 **http://T-Science.org**

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SECTION 31. Economic research, finance, innovation, risk management.

THE DETERMINANTS FOR SHARIA BANK DEPOSITS IN INDONESIA

Abstract: *Islamic banking grows fast in Indonesia. This growth is due to Indonesia being the largest muslim country in the world. This study aims to determine the effect of operating costs on the ratio of operating income, capital adequacy ratios, non-performing finance, funds to deposits ratio and inflation against the results of mudharabah deposits with return on asset as moderating variables. The population in this study is Islamic commercial banks in Indonesia. Sampling using saturated sample method. The data used are annual financial reports obtained from the bank's website and from The Financial Services Authority. The data analysis technique of moderating regression analysis has been used in this study. The results have stated that the operating costs to operating income ratio and capital adequacy have effect to profit sharing of mudharabah deposits. Nonperforming financing ratio, fund to deposit ratios and inflation have no effect to the profit sharing rate of mudharabah deposits. The results also investigate that return on asset as a moderating variable that strengthen the relationship of independent variables with the dependent variable.*

Key words: *Islamic banking, accounting, capital adequacy ratios and non performing financing.*

Language: *English*

Citation: Nur Suci IMM (2018) THE DETERMINANTS FOR SHARIA BANK DEPOSITS IN INDONESIA. ISJ Theoretical & Applied Science, 09 (65): 31-40.

Soi: http://s-o-i.org/1.1/TAS-09-65-6 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.6

1. INTRODUCTION

Islamic banks in running their financial businesses require sufficient sources of funds. One source of funds owned by Islamic banks is funds originating from the community or what is called Third Party Funds (TPF). Most of the operational activities of Islamic banks, especially in channeling financing, depend on the amount of deposits that are able to be collected by Islamic banks [1, p. 97]. If the DPK funds collected by Islamic banks are increasing, the Islamic banks have a great opportunity to increase the amount of financing disbursed to the public. Like banks in general, collection of deposits by Islamic banks is also done by offering demand deposits, savings and deposit. The difference lies in the principle used which is not based on interest (usury), but using the principle of wadiah (deposit) and the mudharabah (investment) principle. Based on these contracts or principles, collection products and Islamic banks consist of wadiah demand deposits, mudharabah savings deposits and mudharabah deposits. Among the Islamic banks' DPK products, mudharabah deposits are fund raising products that provide the largest proportion of total Islamic bank deposits. Mudharabah deposits are unrestricted third party investment products in Islamic banks whose withdrawals can only be made at a certain time with a business division according to the ratio agreed upon at the beginning of the account opening [2, p. 595] and [3, p. 97].

Based on data reported in Islamic banking statistics in 2012-2016 have informed that the amount of mudharabah deposits collected by Islamic banks increased by Rp. 44.07 trillion to Rp. 135.6 trillion. In the span of five years, the number of mudhrabah deposits has grown by 207.48 percent. In addition, as seen from the proportion to the total TPF, the proportion of mudharabah deposits during the period 2012-2016 also increased from 57.9 percent to 62.3 percent (Republika.co.id). Islamic banking is growing faster in Indonesia. This growth was due to Indonesia being a country with citizens whose majority embraced Islam. Now you will be able to easily find Islamic bank offices and automatic teller machines are everywhere. But, in fact there are many more people who do not have enough knowledge about financial products owned by Islamic banks or providers of sharia products such as deposits, and the difference between Islamic deposits and ordinary time deposits. Ordinary people are often confused with financial

products with the addition of sharia brands and common products. Even though deposits have three advantages, the first profit goes hand in hand with risk, both the portion of the ratio or profit sharing, and the third is guaranteed to be profitable.

Whereas Indonesia itself is a country with a majority of Islamic population, thus indirectly the State of Indonesia has enormous potential to develop and strengthen Islamic banking [4, p. 31]. Apart from that, if observed from the large Muslim population in Indonesia, of course Indonesia needs sharia banking more as a choice of savings, savings and deposits that are free from interest [5, p. 1].

Islamic banking can be utilized to strengthen the competitiveness of a nation to take advantage of Islamic banking, it has been tested when the economic crisis hit Indonesia in 1998 and 2008. At that time, Islamic banking remained healthy despite the crisis, but Islamic banks still need revitalization to face the free market.

Financial performance is able to know the level of bank health. It is because financial performance can show the quality of banks through calculating financial ratios. In calculating financial ratios can be done by analyzing the annual financial statements of sharia commercial banks in Indonesia which have been published through the websites of each bank. The rate of profit sharing is the presentation of profit sharing for mudharabah deposits. The use of profit sharing is intended to avoid fluctuations in nominal profit sharing which are affected by changes in the balance of mudharabah deposits [6, p. 30] and [7, p. 126]. With an increase in bank revenues, the level of profit sharing received by customers also increases. Indicators of measuring financial performance are return on assets used to measure the effectiveness of a company in generating profits by utilizing assets owned [8, p. 190].

Return on assets (ROA) is a ratio that shows results (return) on the amount of assets used in a company [9, p. 466]. Moderating variables are types of variables that strengthen or weaken the direct relationship between the independent variable and the dependent variable. Moderating variables are also often referred to as the second independent variable and are often used in linear regression analysis [10, p. 693].

The decline in interest rates forced banks to cut lending rates, including Islamic banking. A number of sharia bankers who are contacted by cash plan to cut the financing yield in the second semester. This decline is in line with the decline in the cost of funds of the sharia industry. For example, BRI Syariah. BRI Syariah Indri Corporate Secretary Tri Handayani projected that financing returns could decrease by 35 basis points (bps) until the end of the year. "This is in line with the recent BI decline some time ago. Until mid-June 2016 recorded BRI Sharia financing yields had shrunk by 184 bps from the beginning of the year. The decline in financing yields was triggered by a cut in deposit yields of 237 bps since the beginning of the year. Sharia hopes that the decline in financing yields can boost financing growth to 19% throughout 2016. Until May 2016, BRI Syariah's financing growth was 11.49% compared to last year, and cutting financing yields are also expected to reduce the non performing financing ratio (NPF) the peg is not more than 3% at the end of the year.

BNI Sharia has the same plan. The projection of a subsidiary of Bank Negara Indonesia (BNI), the amount of reduction in yields on financing will be the same as a decrease in the BI rate or cut 25 bps. Main Director of BNI sharia said, the return on financing BNI Syariah has decreased by 50 bps-100 bps on January period until the end of May 2016. "However, it is estimated that until the end of the year it has not reached a single digit," Imam said to the cash. Based on data from the Financial Services Authority (OJK), the return on financing the profit sharing scheme dropped 27 bps to 11.82%. While deposit yields from Mudharabah dropped 99 bps to around 6.53%.

Research on return on assets to the profit sharing rate of mudharabah deposits shows different results for each researcher, according to research from [11, p. 19] and [3, p. 99] both researchers stated that return on assets equally had a positive effect on the level of profit sharing of mudharabah deposits while the research from [9, p. 470] shows that yield on assets has a negative effect on the profit sharing rate of mudharabah deposits.

Research on operational income operating costs (OCOI) on the profit sharing rate of mudharabah deposits shows different results for each researcher, according to research from [11, p. 19] the researcher states that operating costs of operating income do not affect the profit sharing rate of mudharabah deposits. While the research from [9, p. 469] shows operational costs of operating income have a positive effect on the rate of profit sharing of mudharabah deposits.

Research on capital adequacy ratio (CAR) on profit sharing rates of mudharabah deposits shows different results for each researcher, according to research from [12, p. 10] the researcher stated that the capital adequacy ratio has a positive effect on the profit sharing rate of mudharabah deposits. While research from [3, p. 99] shows that capital adequacy ratio does not affect the profit sharing rate of mudharabah deposits. Research on non-performing financing (NPF) on profit sharing rates of mudharabah deposits shows different results for each researcher, according to research from [13, p. 8] the researcher stated that non-performing financing has a positive effect on the profit sharing rate of mudharabah deposits. Previous research by [3, p. 98] has shown that non-performing financing has no effect on the level of profit sharing of mudharabah deposits.

Research on financing deposit ratio (FDR) on profit sharing rates of mudharabah deposits shows

different results for each researcher, [3, p. 97] has stated that the financing deposit ratio has a positive effect on the level profit sharing of mudharabah deposits. While the research from [12, p. 10] shows that the deposit of rati deposit does not affect the profit sharing rate of mudharabah deposits. This study aims to determine whether there is influence of OCOI, CAR, NPF, FDR and Inflation on the profit sharing rate of mudharabah deposits with ROA as a moderating variable.

2. LITERATURE REVIEW

According to [12, p. 4], OCOI is often called the efficiency ratio used to measure the ability of bank management to control operational costs against operating income. The more efficient operational costs of operating income (OCOI) means the more efficient operational costs incurred by the bank concerned, and any increase in operating income will result in a decrease in profit before tax which in turn will reduce the profit or profitability (ROA) of the bank concerned. Operational income operating costs (OCOI) are calculated by the following formula:

$$\text{OCOI} = \frac{\text{Operating Cost}}{\text{Operating Incomel}} \times 100\%$$

Capital adequacy ratio. According to [3, p. 98] capital adequacy ratio (CAR) shows the ability of banks to provide funds for business development needs and accommodate the risk of loss of funds caused by bank operations. Capital adequacy ratio is calculated by the following formula:

$$\text{CAR} = \frac{\text{Capital x 100 \%)}}{\text{Risk Weighted Asset}}$$

Non-Performing Financing (NPF) is a phenomenon that often occurs in the world of Islamic banking, because one of the main activities of Islamic banking comes from financing distribution. If problematic financing exceeds the limit, it will be a serious problem that will disrupt the profitability of Islamic banks leading to cessation of operations, especially in Islamic banks that have small assets. If problematic financing increases, the risk of a decrease in profitability increases. If profitability decreases, then the ability of banks to expand financing is reduced and the rate of financing becomes decrease. The risk of financing received by a bank is one of the bank's business risks, which results from the non-repayment of loans or investments that are being made by the bank [3, p. 98].

$$\text{NPF} = \frac{\text{Total Non Performing Finance}}{\text{Total Financing}} \times 100\%$$

The financial deposit ratio (FDR) ratio of financing to third party funds is a comparison between financing provided by Islamic banks with third party funds. Financial deposit ratio (FDR) can also be used to assess a bank's strategy. Conservative management usually tends to have a low ratified FDR otherwise if the FDR exceeds the tolerance limit it can be said that the management of the bank concerned is very expensive or aggressive.

Non-performing financing Deposit Ratio (FDR) is calculated by the formula:

$$\text{FDR} = \frac{\text{Total Financing}}{\text{Total Total Third Party Funds}}$$

The profit sharing rate of mudharabah deposits is profit sharing which uses the profit sharing ratio which is usually used in Islamic banks on funding products or deposits of Islamic banks. Savings and Deposits that only produce deposits with investment schemes (mudhrabah) that get return for profit sharing. Indicator of profit sharing level of mudharabah deposits has received by customers against mudhrabah deposit volume. The use of the profit sharing rate has been intended to avoid fluctuations in nominal profit sharing that are affected by changes in mudharabah deposit balances.

The profit sharing rate of mudharabah deposits is calculated by the formula:

$$\frac{\text{profit sharing of syirkah funds}}{\text{syirkah funds}} X\ 100\%$$

According to [9, p. 469] return on assets is a comparison between net income and average assets. Return on assets is a profitability ratio, this ratio measures a company's ability to generate profits at certain levels of sales, assets and share capital. As a moderating variable according to [12, p. 6], return on assets is one of the profitability ratios that measures the effectiveness of a company in generating profits by utilizing the company's total assets, because the return that the company has is greater. Return on assets (ROA) with the formula:

$$\text{ROA} = \frac{\text{Earning before income tax}}{\textit{Total Asset}} \times 100\%$$

3. RESEARCH METHODS

The population in this study is a sharia commercial bank in Indonesia with an observation period of 2012-2016. Sampling using saturated sample method. The data used in this research is secondary data. The data used is the 2012-2016 annual financial statements obtained from the website of each Islamic commercial bank in Indonesia, the financial service authority (OJK) and the Bank Indonesia (BI) website which is the research sample and also retrieves data from IDX. The researcher then uses documentation methods such as the selection of data from various sources before the data is processed. The data analysis technique used in this study has the following stages:

a. Descriptive statistics

Descriptive statistics provide an overview or description of a data which is seen from the mean and standard deviation. [14, p. 74]. However, the research will only use the mean, standard deviation, maximum and minimum.

b. Classic assumption test

Normality test aims to test whether the regression model, residual variables are normally distributed. The multicollinearity Test aims to test whether a good regression model should not have a correlation between independent variables. If the tolerance value is close to 1 and the VIF value is below 10, then there is no multicollinearity problem. Whereas if the tolerance value is close to 1 and the VIF value is above 10, then there is a multicollinearity problem. Autocorrelation Test aims to test whether in the linear regression model there is a correlation between the interfering errors in period t with the confounding error in the period t - 1 (before). Heteroscedasticity test aims to test whether the regression model occurs in residual variance inequality, one observation to another observation.

c. Moderated Regression Analysis (MRA)

This test aims to determine whether return on assets as a moderating variable can strengthen or weaken the relationship of independent variables to the rate of profit sharing of deposits as the dependent variable. This model uses the interaction test model, where the interaction method model is as follows:

$Yi = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5$
$Yi = \alpha + \beta1X1 + \beta6Z + e$
$Yi = \alpha + \beta1X1 + \beta6Z + \beta7X1Z + e$
$Yi = \alpha + \beta2X2 + \beta6Z + e$
$Yi = \alpha + \beta2X2 + \beta6Z + \beta8X2Z + e$
$Yi = \alpha + \beta3X3 + \beta6Z + e$
$Yi = \alpha + \beta3X3 + \beta6Z + \beta9X3Z + e$
$Yi = \alpha + \beta4X4 + \beta6Z + e$
$Yi = \alpha + \beta4X4 + \beta6Z + \beta10X4Z + e$
$Yi = \alpha + \beta4X4 + \beta6Z + e$
$Yi = \alpha + \beta4X4 + \beta6Z + \beta11X4Z + e$

d. Hypothesis Test

The accuracy of the sample regression function in estimating the actual value can be measured using the Goodness of fit. Statistically, at least this can be measured by the statistical value F, the coefficient of determination, and the statistical value t. The testing of this hypothesis is carried out to measure the relationship between independent, dependent and moderating variables. F test is used to see how the influence of all the independent variables on the dependent variable and the moderating variable. The Determination Coefficient basically measures how far the model's ability to explain the variation of the dependent variable. The coefficient of determination is between zero and one. A small R2 value means that the ability of independent variables in explaining the variation of the dependent variable is very limited. The fundamental weakness in using the coefficient of determination is the bias towards the number of independent variables entered into the model. Test statistic t basically shows how far the effect of the independent variable, the dependent variable and the moderating variable. The test is done using significance level 0.05 ($\alpha = 0.05$).

4. RESULT AND DISCUSSION

1. Descriptive Test

The minimum profit sharing rate for mudharabah deposits is 0.04 which is owned by Bank BNI Syariah in 2012. This value shows that the profit sharing rate of mudharabah deposits to customers is smaller. So that the average profit sharing rate given to customers experiences the smallest value of the total third party funds for temporary syirkah funds compared to other Islamic commercial banks. The maximum value is 0.08 which is owned by BJB Syariah Bank in 2015, where the value shows the profit sharing rate of mudharabah deposits amounting to 0.08 of the total third party funds in the form of temporary syirkah funds. The average profit sharing rate is 0.05 which indicates an increase in the standard deviation value of 0.01 which is small compared to the mean, meaning that the distribution of data on the profit sharing rate of mudhrabah deposits is not too varied.

The minimum operational cost of operating income is 0.24 owned by Panin Syariah Bank in 2014. This value indicates that the operating costs of Panin Syariah Bank are smaller than other Sharia Commercial Banks. The maximum value is 1.95 which is owned by Bank BCA Syariah in 2013, where the value shows the level of operating costs operating income of 1.95. The average operating cost of sharia commercial bank operating income is 0.18 which indicates that the average Sharia commercial bank conducts bank operations at 0.18 with a standard deviation of 0.34.

The minimum capital adequacy ratio (CAR) is 0.07 which is owned by Bank Mandiri Syariah in 2016. This value indicates that the level of funds or capital provided to overcome losses is smaller compared to other Islamic Commercial Banks. The maximum value is 0.42 owned by Bank BJB sharia in 2015, where the value shows a capital adequacy ratio of 0.42 of the total capital owned by the bank to overcome losses. The average capital adequacy ratio is 0.18 which indicates an increase in the standard deviation value of 0.71, which is small compared to the mean.

The minimum value of non-performing financing (NPF) is 0,00082 owned by Bank BCA Syariah in 2014. This value shows that the problematic financing is very low compared to other Islamic commercial banks. While the maximum value is 0.42218 which is owned by Bank Muamalat in 2016, where the value shows that Muamalat's non-performing financing Bank has a problematic financing that is quite high in excess of other Islamic banks. The non-performing financial average is 0.06249 which shows that the

average Islamic banks in Indonesia have non-performing financing from the total financing that has been carried out with a standard deviation of 0.07549.

The minimum financing deposit ratio (FDR) is 0.23 owned by Bank Mega Syariah in 2013. This value shows that banks provide funds to debtors that are less effective in collecting and channeling funds compared to other Islamic banks. The maximum value is 12.59 which is owned by Panin Syarih Bank in 2016, where the value shows that Bank Panin Syariah's financing deposit ratio has the ability to provide funds for debtors so that the opportunity to generate profits is greater than other Islamic banks. The average financing deposit ratio is 2.25 which shows that the average Islamic bank in Indonesia has funds collected from third parties with a standard deviation of 2.18.

The minimum value of return on assets (ROA) is 0,00014 owned by Bank Victoria Syariah in 2013. This value indicates that banks earn a profit in using their assets smaller than other sharia banks. The maximum value is 0.04052 which is owned by Bank Mega Syariah in 2016, where the value shows that the return on assets of Mega Syariah Bank has a profit in using its assets greater than other Islamic banks. The average return on assets is 0.00841 which shows that the average of Islamic banks in Indonesia with a standard deviation is 0.00749.

2. Classic Assumption Test

a. Normality test

Table 1

Normality Test Results

	Unstandardized Residual
Kolmogorov-Smirnov Z	0,134
Asymp. Sig (2-tailed)	0,057

Based on Table 1 shows the results of testing Komogorov-Smirnov with data that is normally distributed, because the significant level of One Sample Kolmogorov-Smirnov Test is greater than 0.05

b. Multicolinearity Test

The Multicollinearity Test aims to test whether a good regression model should not have a correlation between independent variables. If the independent variables are correlated, these variables are not orthogonal. The orthogonal variable is an independent variable with a correlation value between fellow independent variables equal to zero. According to [14, p. 70]. Multicoloniearity is seen from (1) the value of the tolerance of the opponent (2) variance inflation factor (VIF). If the tolerance value is close to 1 and the VIF value is below 10, then there is no multicollinearity problem. Whereas if the tolerance value is close to 1 and the VIF value is above 10, then there is a multicollinearity problem. The result of multicolinearity testing:

Table 2

Multicollinearity Test Results

Independent Variables	*Tolerance*	VIF
OCOI	0,782	1,278
CAR	0,724	1,381
NPF	0,854	1,171
FDR	0,764	1,310
INFLATION	0,949	1,054

Based on Table 2 shows the results that do not contain multicollinearity because no tolerance is smaller than 1. So that shows the results that there is no multicollarity between independent variables in the regression model.

c. Autocorrelation Test

Table 3

Autocorrelation Test Results

	Unstansdardized Residual
Z	0,000
Asymp. Sig. (2-tailed)	1,000

Based on Table 3 shows the results of the runs test, where the value is asymp. Sig (2-tailed) of 1,000. This can be stated that there is no autocorrelation.

d. Heteroscedasticity Test

Table 4

Heteroscedasticity Test Results

Dependent Variable	Independent Variables	Sig
POSF	OCOI	0,933
	CAR	0,734
	NPF	0,546
	FDR	0,722
	Inflation	0,768

Based on Table 4 shows the results of testing the absence of heteroscedasticity in the variables OCOI, CAR, NPF, FDR, Inflation> 0.05, where the results are significant above the 0.05 level.

3. MRA Test (Moderated Regression Analysis)

This test aims to determine whether return on assets as a moderating variable can strengthen or weaken the relationship of independent variables to the rate of profit sharing of deposits as the dependent variable (Ghozali 2016: 211). Based on appendix 12 the following equation is produced:

1. POSF = 0.054 - 0.013 OCOI + 0.066 CAR + 0.002 NPF + 0,000 FDR + e
2. POSF = 0.065 - 0.007 OCOI-0.244 ROA + e
3. POSF = 0.065 - 0.006 OCOI -1,338 ROA + 1,119 OCOI * ROA + e
4. POSF = 0.052 + 0.050 CAR - 0.312 ROA + e
5. POSF = 0.052 + 0.046 CAR-0.417 ROA + 0.611 CAR * ROA + e
6. POSF = 0.062 0 - 0.009 NPF - 0.338 ROA + e
7. POSF = 0.061-0.011 NPF-0.191 ROA - 3,763 NPF * ROA + e
8. POSF = 0.057 + 0.001 FDR - 0.298 ROA + e
9. POSF = 0.060 + 0,000 FDR - 0.530 ROA + 0.186 FDR * ROA + e
10. POSF = 0.060 - 0.003 Inflation - 0.284 ROA + e
11. POSF = 0.061 - 0.002 Inflation - 0.323 ROA - 0.093 Inflation * ROA + e

These equations show that equations 2 and 3 $\beta 6$ = - 0.244 and $\beta 7$ = 1.119. Based on these results it can be seen $\beta 6 \neq \beta 7 \neq 0$, then return on assets is a quasi moderation variable to influence the operating costs of operating income on the profit sharing rate of mudharabah deposits. Equations 4 and 5 $\beta 6$ = - 0,312 and β80,611. Based on these results it can be seen that $\beta 6 \neq \beta 8 \neq 0$, then return on assets is a quasi moderation variable to influence the capital adequacy ratio to the profit sharing rate of mudharabah deposits. Equations 6 and 7 $\beta 6$ = - 0,338 and $\beta 9$ 3,763. Based on these results it can be seen $\beta 6 \neq \beta 9 \neq 0$, then return on assets is a quasi moderation variable to influence non-performing financing against the profit sharing rate of mudharabah deposits. Equations 8 and 9 $\beta 6$ = - 0.298 and β100,186. Based on these results it can be seen that $\beta 6 \neq \beta 10 \neq 0$, then return on assets is a quasi moderation variable to influence financial deposit ratio to the profit sharing rate of mudharabah deposits. Equations 10 and 11 $\beta 6$ = - 0,284 and β11-0,093. Based on these results it can be seen that $\beta 6 \neq \beta 11 \neq 0$, then return on assets is a quasi moderation variable to influence inflation on the profit sharing rate of mudharabah deposits.

4. Hypothesis Test

F test is used to see how the influence of all the independent variables on the dependent variable and the moderating variable. This test uses sig. Level 0.05 (α = 0.05).

Table 5

Test Result F

Sum of Squares	F	Sig
0.002	2,872	0,028

F test was 2.872 with a significance level of 0.028 <0.05. The results show that the variables OCOI, CAR, NPF, FDR and Inflation simultaneously affect the rate of profit sharing of mudharabah deposits of sharia commercial banks for the period 2012-2016.

Table 6

R^2 Test Results

R Square	Adjusted R Square
0,285	0,186

Based on Table 6 has shown that the level of determination (R^2) is 0.186 or 18.6%. This show that the 18.6% profit sharing rate of mudharabah deposits can be explained by the variables OCOI, CAR, NPF, FDR, and Inflation. While the rest (100% - 18.6% = 81.4%) is explained by other variables outside this research.

Table 7

t-Test Results

	B	T	Sig
Constan	0,054		
OCOI	-0,013	-2,447	0,019
CAR	0,066	2,456	0,019
NPF	0,002	0,068	0,946
FDR	0,000	0,540	0,593
Inflation	0,003	1,142	0,261

Discussion

This study aims to determine whether there are influences of OCOI, CAR, NPF and FDR on the profit sharing rate of mudharabah deposits with ROA as a moderating variable.

1. Effect of OCOI on the Profit Sharing Rate of Mudharabah Deposits

To measure bank efficiency, one of the indicators used is a comparison between operational costs and operating income (OCOI). The smaller the OCOI ratio means the more efficient the operational expenses incurred by the bank concerned so that the likelihood of a bank in a problematic condition gets smaller. Operational efficiency also affects the performance of the bank, namely to show whether the bank has used all of its production factors appropriately. Theoretically, the efficiency of Islamic banking production in issuing costs in the form of financing investment is one form of the bank's production mechanism in order to generate the highest income from an investment [1, p.100].

The test results of this study indicate that OCOI influences the profit sharing rate of mudharabah deposits, because the Sharia commercial bank has been efficient in managing the operational expenses incurred by the bank concerned so that the probability of a bank in troubled conditions is getting smaller and will not affect the level of profit sharing. So the high OCOI will not reduce the profit sharing rate of mudhrabah deposits. The results of this study support the research of [12, p. 13] which states that OCOI affects the profit sharing rate of mudharabah deposits.

2. Effect of CAR on the Profit Sharing Rate of Mudharabah Deposits

Capital adequacy ratio (CAR) is the ratio of the bank's performance to measure the capital adequacy of a bank to support or generate risk, for example the financing provided. The amount of capital of a bank

will affect the level of public trust in the performance of the bank. Increasing public confidence in the bank, the bank will reduce interest rates and at the same time the bank does not need to worry about losing customers because of the high public trust in the bank [2, p. 600]. The test results of this study indicate that CAR affects the profit sharing rate of mudharabah deposits, because Islamic banks have capital adequacy to bear the risk of bad credit, so that a good bank performance and will result in the bank's ease in distributing profit sharing that will give more trust to the public to invest their funds in a sharia public bank. So the high CAR will affect the profit sharing rate of mudharabah deposits. The results of this study support research from [3, p. 99] which states that CAR affects the profit sharing rate of mudharabah deposits.

3. Effect of NPF on the Profit Sharing Rate of Mudharabah Deposits

Non-performing financing (NPF) is a problematic financing experienced by a bank, problematic financing will obviously affect the bank's performance as a financial institution and will have an impact on the profit that will be obtained by the bank. If non-performing financing shows a low value, then the income will increase so that the resulting profit will increase, but on the contrary if the value of non-performing financing is high, the income will decrease so that the profit will also decrease [9, p. 470]. The test results from this study indicate that the NPF has no effect on the level of profit sharing of mudharabah deposits, because the Islamic commercial banks have been selective in channeling their financing funds. In addition, the bank already has a good reserve and also has carried out risk analysis later on the distribution of financing funds will not affect the level of profit sharing of mudharabah deposits. So the high non-performing financing will affect the profit sharing rate of mudharabah deposits that will be carried out by Islamic banks. The results of this study support the research of [9, p. 469] which states that NPF has no effect on the level of profit sharing of mudharabah deposits.

4. Effect of FDR on the Profit Sharing Rate of Mudharabah Deposits

Financing deposit ratio (FDR) is a ratio that shows the ability of a bank to provide funds to debtors with capital owned by banks and funds that can be collected from the public. Financing deposit ratio shows whether or not banks are effective in channeling financing, where the direction of the relationship between fianncing deposit ratio to profit sharing rate of mudharabah deposits is positive, because if a bank is able to provide funds and channel it to customers it will increase the return obtained and affect the increase in profit sharing Mudharabah deposits obtained by Islamic banks [9, p. 466]. The test results from this study indicate that FDR does not affect the profit sharing rate of mudharabah deposits, because Islamic commercial banks can manage margins received from financing well, so that if the FDR falls the rate of profit sharing does not decrease. Therefore, the results of this study indicate that FDR does not affect the level of profit sharing of mudharabah deposits. So the high FDR will not reduce the profit sharing rate of mudharabah deposits.

The results of this study do not support the research of [9, p. 471] which states that FDR affects the return on assets of Islamic Commercial Banks in Indonesia which will then be given to customers who have mudharabah deposits in the form of profit sharing. But the results of this study support the research of Nur (2013) which states that FDR has no effect on the level of profit sharing of mudharabah deposits.

5. Effect of Inflation on the Profit Sharing Rate of Mudharabah Deposits. Statistic t test has shown that inflation has no effect to profit sharing of mudharabah deposit. Since inflation is fluctuates factor that can be controlled by Indonesian government. During research period inflation growth was stable relatively and economic growth was good. Customers of Islamic banking in this situation have enough deposit but respectively they spent to consume.

6. ROA Moderates the Influence of the Relationship between OCOI and the Level of Profit Sharing of Mudharabah Deposits

Return on assets (ROA) is a company's ability to obtain profits expressed in percentage. Retirement on assets is chosen as an indicator of bank financial performance measurement because return on assets is used to measure the company's effectiveness in making profits by utilizing assets owned. [12, p. 1-16] said that to measure bank efficiency, one of the indicators used is the comparison between operational costs and operating income (OCOI). The smaller the OCOI ratio means the more efficient the operational expenses incurred by the bank concerned so that the likelihood of a bank in a problematic condition gets smaller.

The test results of this study indicate that return on assets can be as a moderator on the effect of operating income on operating income on the profit sharing rate of mudharabah deposits as well as return on assets can be an independent variable that can affect the profit sharing rate of mudharabah deposits. So return on assets (ROA) can strengthen or weaken the relationship between operating income operating costs against (OCOI) the profit sharing rate of mudharabah deposits. The results of this study do not support the research of [11, p. 19] which states that OCOI influences ROA. It is because sharia commercial banks are efficient in managing the operational expenses incurred by the bank concerned

so that the possibility of a bank in a problematic condition gets smaller and will increase the profit of the bank and make it easier for the bank to make a profit sharing.

7. ROA Moderates the Effect of the Relationship between CAR on the Profit Sharing Rate of Mudharabah Deposits.

Return on assets (ROA) is a company's ability to obtain profits expressed in percentage. Retirement on assets is chosen as an indicator of bank financial performance measurement because return on assets is used to measure the company's effectiveness in making profits by utilizing assets owned [13, p. 9]. According to [9, p. 470] the amount of capital of a bank will affect the level of public confidence in the bank's performance, then the stronger the bank's ability to bear the risk of any risky financing or productive assets. The test results of this study indicate that return on assets can be as a moderator on the effect of capital adequacy ratio on the profit sharing rate of mudharabah deposits as well as return on assets can be an independent variable that can affect the profit sharing rate of mudharabah deposits. So return on assets can strengthen or weaken the relationship between capital adequacy ratio and the profit sharing rate of mudharabah deposits. The results of this study support research from [3, p. 100] which states that CAR affects the ROA. Because when the capital owned by the bank is so large, the financing made by the bank is also so high that it will cause the bank to get a return that is so high and will also have an impact on the profit that will be obtained by the bank.

8. ROA Moderates the Influence of the Relationship between the NPF and the Profit Sharing Rate of Mudharabah Deposits.

Return on assets (ROA) is a company's ability to obtain profits expressed in percentage. Retirement on assets is chosen as an indicator of bank financial performance measurement because return on assets is used to measure the company's effectiveness in making profits by utilizing assets owned [13, p. 10]. [9, p. 466] stated to measure the ability of banks to manage non-performing financing that has doubtful, substandard or stalled quality. If non-performing financing shows a low value, then the income will increase so that the resulting profit will increase. The test results of this study indicate that return on assets can be as a moderator on the effect of non-performing financing on the profit sharing rate of mudharabah deposits as well as return on assets can be an independent variable that can affect the profit sharing rate of mudharabah deposits. So return on assets can strengthen or weaken the relationship between non-performing financing to the profit sharing rate of mudharabah deposits.

The results of this study support the research of [9, p. 470) which states that NPF has no effect on the level of profit sharing of mudharabah deposits. The effect of non-performing financing on return on assets does have an inconsistency in the relationship between buying and selling financing with return on assets, so that the condition of greater non-performing financing in one period does not directly give a decrease in profit in the same period.

9. ROA Moderates the Influence of the Relationship between FDR and the Level of Profit Sharing of Mudharabah Deposits.

Return on assets (ROA) is a company's ability to obtain profits expressed in percentage. Retirement on assets is chosen as an indicator of the measurement of banking financial performance because return on assets is used to measure the effectiveness of the company in generating profits by utilizing assets owned. According to [9, p. 473] stated that the financing to deposit ratio (FDR) is the ratio of financing to third party funds which shows how much the bank is capable of repaying withdrawals made by depositors by relying on loans that have been provided as a source of liquidity. The test results of this study indicate that return on assets can be as a moderator on the effect of financing to deposit ratio on the profit sharing rate of mudharabah deposits as well as return on assets can be an independent variable that can affect the profit sharing rate of mudharabah deposits. So return on assets can strengthen or weaken the relationship between the financing to deposit ratio to the profit sharing rate of mudharabah deposits.

The results of this study do not support the research of [2, p. 599] which states that FDR does not affect the level of profit sharing of mudharabah deposits. But it supports the research from [9, p. 470] which states that financing to deposit ratio influences the return on assets of Islamic Commercial Banks in Indonesia. Because when the distribution of funds to the public is high it will get a high return as well and will have an impact on the profit obtained by the bank, so that the bank can provide a fairly good profit sharing [4, p. 35].

10. ROA Moderates the Influence of the Relationship between inflation and the Level of Profit Sharing of Mudharabah Deposits. Moderating regression analysis has also investigated return on asset strengthens the relationship between inflation and profit sharing of mudharabah deposits.

5. CONCLUSIONS AND SUGGESTIONS

This study aims to determine the effect of OCOI, CAR, NPF, FDR and Inflation on the profit sharing rate of mudharabah deposits with ROA as a moderating variable with research period were 2012-2016. The results of the study informed that OCOI, CAR affects the profit sharing rate of mudharabah

deposits. NPF, FDR and inflation have no effect on the level of profit sharing of mudharabah deposits. ROA in this study can be a moderating variable that strengthens the relationship of independent variables with the dependent variable. The results of the analysis argue that the large development of Islamic banks in Indonesia needs to increase caution against bank capital factors and operational costs in order to increase profit sharing for mudharabah deposits. The ability of bank to optimize assets owned to generate net income is believed to be able to strengthen the ability of Islamic banks to optimize their capital and financial resources to increase the amount of profit sharing for mudharabah deposits. The limitation of this study is that it has not been able to disclose in more detail the increase in profit sharing for mudharabah deposits as a result of an increase in bank capital to make operational costs efficient. Limitations in the number of research samples also become a part that must be strengthened for further research using the Sharia Business Unit.

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Impact Factor:			
ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 2.031	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 12.09.2018 http://T-Science.org

SECTION 1. Theoretical research in mathematics.

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SOME QUESTIONS OF DESIGN OF TASKS IN MATHEMATICS

Abstract: *In the article about the essential features of the system of problems given a definition to the system of problems; the directions of designing systems of problems in mathematics are considered.*

Key words: *Mathematics, the problem, the construction of mathematical problems, the methods of constructing mathematical problems.*

Language: *English*

Citation: Nishonov FM, Kurpayanidi KI (2018) SOME QUESTIONS OF DESIGN OF TASKS IN MATHEMATICS. ISJ Theoretical & Applied Science, 09 (65): 41-44.

Soi: http://s-o-i.org/1.1/TAS-09-65-7 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.7

Introduction

In the information society, mathematical education is an important factor in the adaptation of the individual to the existing realities. Analysis of global trends in the development of education attests changes in its content, methods and organizational forms in connection with the wide use of information educational technologies. Thus, the development of these technologies is much faster than the pedagogical development of their usage in the educational process.

Thereby, overall comprehensive development of pupilsat schools and academic lyceums, the formation of their personalities and the professional success are impossible without a substantial reliance on a high level of mathematical preparation. The most important educational activity, which allows schoolchildren to learn mathematical theory, develop their creativity and independence of thinking, is problem solution. In our conviction, math problems are the main means of forming knowledge, skills and abilities of students, the development of schoolchildren by organizing educational activities. Subsequently, the efficiency of teaching and educational process depend on the choice of tasks, the methods of organizing student activities to solve them, i.e. the methodology for problem solution.

Considering the essential characteristics of the concept "task", the essential features of the concept "system of tasks" are highlighted; the essence of methods and techniques for constructing systems of problems in mathematics are revealed.

We proceed from the assumption that the theoretical foundations of designing systems of problems in mathematics are the concepts "task" and "system of tasks", requirements to the system of problems and design rules that provide these requirements, mechanisms for constructing task systems.The multidimensionality of the concept "task" is revealed through the analysis of the phenomenon from the point of view of psychological, didactic and systemic approaches.

Materials and Methods

The psychological approach emphasizes the objective nature of the problem; considers it from the point of view of the components of the activity in which the method of activity is to be found - the achievement of a certain result under certain conditions; defines the problem as a subjective education that relates to the decision maker, when the problem is decided by the decider, the goal is realized and there is a desire to solve it.

In the didactic approach, the task is considered as a form of the embodiment of the teaching material and a learning tool.

The system approach allowed to distinguish invariant characteristics of the concept provided in

the definition: the problem - system "solver - a system of tasks", the second component which has at least one discrepancy (for example, between a condition and a requirement) in its structure, and for determination of which the solver's actions are directed after recognition and acceptance of this system.

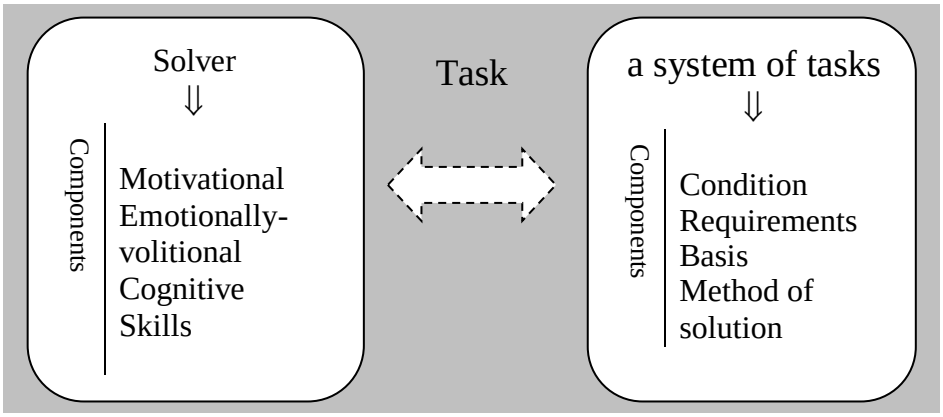

Fig.1.Static structure of the problem.

In interaction of the solver and the target system, both the system (the transformation of conditions, the change in the connection between objects, etc.) and the subject (the appropriation of knowledge, skills, experience) are subject to change.

Changes in the task system are dictated by a certain goal - didactic (for understanding the condition of the problem, mastering the way of solving, understanding the concept, etc.), developing (for development of critical thinking, development of analytical and synthetic skills, etc.), educational (for the development of interest in the subject, the formation of collectivistic qualities of the individual, etc.), controlling (for checking the completeness of knowledge, the formation of skills, etc.), organizing (for the organization of collective, pair work, providing the differentiation of education, etc.), and in certain cases lead to the emergence of the system of tasks.

To distinguish the essence of the concept of "system of problems", the task loops (G.V. Dorofeev)[1], chains (D.Poya) [2], blocks (E.V. Sukhorukova, S.V. Arutyukin, A.P. Karp) [3], cross-cutting problems (N.Y. Vilenkin, A. Satvoldiev)[4], developing (M.S. Nikolsky)[5], multi-step (M.I. Zaikin)[6], multi-stage (M. Klyakly)[7], open (H. Merlin, A.V. Merlin)[8], compact problems (T.V. Ignatieva)[9] have been taken into consideration.

On the basis of highlighting the essential features of the system of tasks (the presence of a specific goal, ensuring the expected result, selectivity and ordering of the elements) given a definition: a system of tasks is a set of tasks ordered and matched in accordance with the goal acting as one whole, the interconnection and interaction of which lead to the intended result.

The result of the analysis of the works of A.G. Ball [10], V.V. Guzeeva [11], F.M. Yunusova, G.A. Kovaleyova, T.Yu. Dumina [12], etc. became the allocation of requirements to the system of tasks:

1) to the structure of the system (hierarchy, rationality of volume, increasing complexity);

2) to the functioning of the system as a whole (target sufficiency, completeness, adequacy of the content of education);

3) to tasks as elements of the system (the purpose of each task in the system of tasks, the possibility of implementing an individual approach).

The fulfillment of the requirements of the system of tasks ensures the rules of constructing: the rule of accessibility (correspondence to the level of training, the consideration of the psychological characteristics of age groups), the rule of uniformity (selection or compilation of similar tasks in accordance with the regularity of the appearance of incorrect associations, identified by the psychologist P.A. Shevarev)[13], the rule of diversity (the inclusion of tasks that are diverse in form, content and method of solution), the rule of opposition (inclusion of tasks in similar and reciprocal concepts, tasks that do not have solutions or counterexamples), the rule of goal consideration (selection of tasks in accordance with the purpose of using the system, with the special purpose of every tasks in the system) the rule of completeness (compliance with the system of knowledge, skills and abilities, the study of which is provided), the rule of complication (the location of tasks in the system) , the rule of structuralism (mutual subordination), the rule of individualization (taking into account the individual characteristics of students).

The result of the analysis of various constructions of problem systems was the

systematization of knowledge about the methods of construction. Comprehending the method of constructing the system of problems ordered in accordance with the goal of the tasks in aggregate which provides the last system characteristics; the following methods for constructing the systems of learning tasks are outlined: the method of varying the problem, the method of key problems, the target task method, the "snowball" method.

The essence of the method of varying the problem is that each problem of the system is obtained from this task by varying its content or form.

The content of a task is understood as the totality of its components: condition, requirement, basis and method of solution. Variation, specifically, is interpreted very widely. This is not only a change, but also replacement of objects and (or) relations, addition and (or) withdrawal of components (conditions, requirements).

As a result of varying, conditions may turn out as non-standardized (indeterminate, variational, overdetermined, contradictory, provocative) tasks as opposed to standardized, or definite ones, containing in condition a necessary and sufficient amount of data to obtain the only possible answer.

Problems with an unformed requirement are examples of variation of requirement.

Variation of the basis and method of solution, as a consequence, leads to the solution of one problem using different methods.

The next method is to compile a system of problems built on the principle that "each task of the system uses the result of the solution (statement or method) of the key problem" - the method of the key task. There are two points of view on the concept of a key problem - task-fact and task-method. While studying any topic of the school course, pupils can select a certain minimum of key tasks, by assimilating their solutions schoolchildren will be able to solve any task at the level of program requirements of a particular learning topic[14].

The method of the target task involves the allocation of a quite complex problem, the solution of which is divided into a number of simple ones. The division of the target task into elementary ones is carried out on the basis of analysis which leads to the students' comprehension of the idea of a solution or proof.

The "snowball" method means to use the results of the solution of previous problem while solving each problem of the system. Since the result of the solution of the problem can be both a proven fact about the object and the method implemented in the solved problem, we distinguish two versions of the "snowball": the use of the proved statement and the repetition of the operations undertaken in the previous problem.

Conclusion

In conclusion, main methods of constructing systems of tasks - the reception of reciprocal and opposite tasks, the reception of generalization and concretization, the reception of analogy – have been highlighted.

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Impact Factor:			
ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 2.031	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 18.09.2018 **http://T-Science.org**

SECTION 20. Medicine.

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ASSESSMENT OF PATIENT'S DOSE DURING AP PELVIS RADIOGRAPHIC EXAMINATION IN SELECTED HOSPITALS OF AL NAJAF CITY, IRAQ

Abstract: *Background: Protecting patients reproductive organs from unnecessary radiation is paramount during anterior-posterior (AP) pelvis radiography. Therefore, assessing patients' dose is necessary to ensure that the doses are within recommended levels.*

Objective: This work is aimed at investigating patients' radiation dose undergoing AP pelvis x-ray examination in selected hospitals of Al Najaf.

Material and Method: Patients' doses were assessed for 93 patients. The Entrance Surface Dose (ESD) was calculated through the knowledge of X-ray tube output and exposure factors. The X- ray output was measured using a calibrated dosimeter for each X-ray tube. Seven X-ray tubes were used to assess the patients' ESD. Exposure factors (e.g. tube potential (kVp), tube loading (mAs) and X-ray source to image detector distance-SID (cm)) were recorded for each patient. This data was used to calculate the ESD taken into account the backscatter factor. Four main hospitals were selected in this study, namely, Al Sadder (ASTH)), Al Hakeem (AHGH), Al Furat (AFH) and Al Zahraa(AZH).

Results: The mean ESD value for AP pelvis X-ray examination was ranged from 0.81± 0.16 mGy to 3.4±0.36 mGy across all hospitals. The corresponding means of each of kVp used for this examination was ranged from 73.3 to 87.3 kVp; mAs: ranged from 13.6 to 35.38 mAs and for the SID the range was between 100 and 123.07 cm. The value of max/min of the ESD was ranged from 1.5 to 3.3 across different hospitals

Conclusion:

The results demonstrate a clear variation in patient dose and exposure factors set among the selected hospitals. These values (i.e. ESD) were seen to be slightly comparable to those values of the UK (Survey-2010, 3.2 mGy) and were higher than those reported by certain countries (e.g. Iran, Sudan etc.). Therefore, a periodic checking together with conducting a quality control testing is highly recommended.

Key words: *ESD, AP pelvis, Patient dosimetry, Radiation safety, Radiation protection*

Language: *English*

Citation: Abid Ali Bakir H, Azeez AJ (2018) ASSESSMENT OF PATIENT'S DOSE DURING AP PELVIS RADIOGRAPHIC EXAMINATION IN SELECTED HOSPITALS OF AL NAJAF CITY, IRAQ. ISJ Theoretical & Applied Science, 09 (65): 45-52.

Soi: http://s-o-i.org/1.1/TAS-09-65-8 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.8

Introduction

Increasing the knowledge concerning the hazards associated with exposure of patient to low doses of ionizing radiations during diagnostic X-ray examinations impose the need for radiation dose assessment [1]. In this regards, a number of organizations that specialized in the radiation protection have issued recommendations which aimed to reduce the patients' doses to its lowest levels. These include organizations such as the International Commission on Radiological Protection-ICRP [2], International Atomic Energy Agency (IAEA)[3], and European Commission, 2000. Imaging of different body parts necessitate that different radiographic techniques must be adopted to meet the requirement of X-ray attenuation which, in turn, include different exposure levels especially for those thick parts that requires high dose for a proper penetration such as in AP pelvis radiography [4]. Nevertheless, it should be noted that the pelvic region include the gonads which are considered to be one of the most radiosensitive organs in the body [3]. This means that, during pelvic X-ray examination,

the reproductive organs are inevitably exposed to the primary beam of X-ray and, therefore, the risk of inducing cancer within next generations does exist [5]. According to the literature, AP pelvis together with hip radiography has been reported to be the 3rd most frequent X-ray examination when compared with the biggest dose contribution examinations in the United Kingdom, with a 39/1000 of population annual frequency [6]. Therefore, protecting patients gonads from unnecessary radiation dose is paramount during anterior-posterior (AP) pelvis radiography. Measurement of patient dose during AP pelvis X-ray examination was one of the aims of many researches [7-10]. However, other research attempts were conducted to minimize the patient dose during AP pelvis radiographic examination through optimizing its radiographic practice [11-13]. Optimization means finding an approach through which the dose can be reduced while maintaining the quality of the X-ray image acceptable for diagnosis [14]. One of most common and reliable dosimetric quantities used in diagnostic radiography to give an indicator for patient dose is the entrance surface dose (ESD). This quantity includes the contribution of backscatter radiation in the range of diagnostic X-ray (i.e. 40 to 150 keV) [15]. Assessment of patient dose undergoing routine radiographic examinations and specifically the AP pelvis X-ray projection has not been given the required attention that recommended by radiation protection organizations in Iraq and in Al Najaf in specific. Hence, this study is aimed at investigating the patient dose undergoing AP pelvis projection in selected hospitals of Al Najaf using indirect based dosimeric approach (i.e. depend on the knowledge of X-ray output measurements)

Material and methods

This study was undertaken in selected hospitals of Al Najaf city, Iraq; these include Al Sadder teaching hospital (ASTH), Al Hakeem general hospital (AHGH), Al Zahraa (AZH) and Al Furat Al Ausit hospitals (AFAH)). These hospitals were selected because they were covered the whole center of the city. Seven X-ray tubes were involved in this work. Before work was started, an ethical approval was obtained from the Al Najaf Health Administration of Al Najaf city. The research began by collecting information about the X-ray units; this includes X-ray tube manufacturer, model, year of installation and the type of the X-ray system (i.e. computed or digital radiography- CR/DR). These data are listed in table 1.

Table 1.

This table presents the X-ray systems information considered in this research.

Hospital	Manufacturer	model	Year of installation	System types (DR/CR)
ASTH	Siemens/Germany	AL01C	2017	DR
AHGH (1)*	Shimadzu/Japan	R-20J	2006	CR
AHGH (2)**	Shimadzu/Japan	R-20J	2006	CR
AZH (1)	Shimadzu/ Japan	R-20J	2015	CR
AZH (2)	Shimadzu/ Japan	R-20J	2006	CR
AFAH(1)	Shimadzu/Japan	R-300	2005	CR
AFAH (2)	Shimadzu/ Japan	1/2P13DK	2012	CR

* and ** Refer to the room numbers in a given hospital.

Following this, demographic data were collected for all patients enrolled in this study, this includes patients' weight (kg), height (cm) and gender (male/female); these data were used to calculate the body mass index(BMI = kg/cm^2) for individual patient. A minimum number of 10 patients (≥18 years) was considered for each X-ray unit [16]. This led to 93 patients in total (male and female) to be enrolled.

Prior to the dose calculation, exposure/physical factors were recorded for individual patient and X-ray projection. These include kVp (peak tube voltage), mAs (milli amper. second) and and X-ray source to image detector distance-SID (cm). The latter parameters are necessary to calculate the ESD (mGy = J/kg). The ESD is the absorbed dose in air on the X-ray beam axis at a point where the beam is just entering the skin of the patient. The ESD calculation includes the backscatter contribution. The ESD was then calculated using the following equation [17, 18]

$$ESD\ (mGy) = output\ \left(\frac{mGy}{mAs}\right) \times \left(\frac{kVp}{80}\right)^2 \times \left(\frac{100\ cm}{FSD}\right)^2 \times mAs \times BSF$$

where output is the X-ray tube output factor in mGy/mAs measured at a standard distance of 100 cm from the X-ray tube focus and 80 kVp normalized to 10 mAs, kVp is the peak tube potential, mAs is the product of the tube current (mA) and exposure time (sec), FSD is the focus to patient surface (skin) distance (cm). The FSD was calculated by subtracting the patient thickness (cm) from the SID. Patient thickness used in this work was sourced from perry et al [19] since measuring patient thickness directly during workload is difficult and might cause some inconvenience for the patients. The BSF is the backscatter factor and a value of 1.35 is usually used in diagnostic range [19].

The X-ray output (R/mAs) was measured using Rad-Check Plus model 06-526 X-ray exposure meter (Nuclear Associates, Victoreen Division, NY, USA) at 80 kVp, 10 mAs and 100 cm distance from tube focus (see figure 1). Three measurements were taken to allow the calculation of average value and to reduce random error. A 8.7 mGy/R conversion factor was applied to convert the output from R (Roentgen) to mGy in air (i.e. 1 R = 8.7 mGy) [20]. The ESD was finally calculated for all patients.

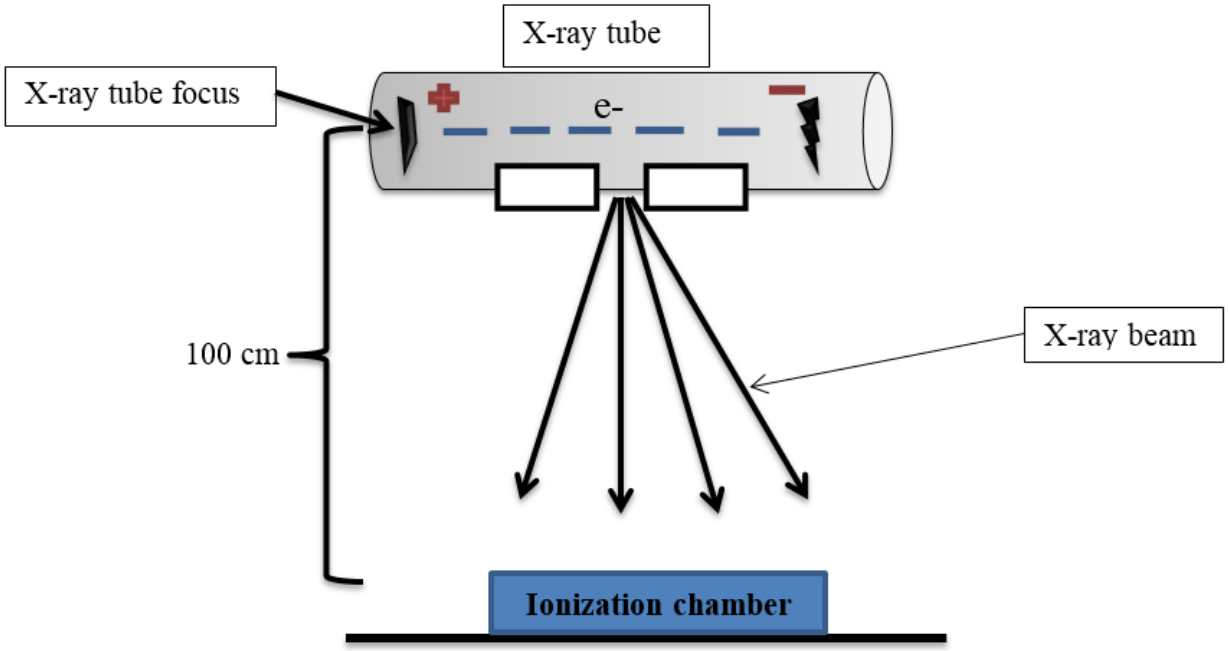

Figure 1. A schematic diagram illustrates the procedure of measuring X-ray output.

Results

Ninety three patients who were examined for AP pelvis radiography were recorded in this study. The study data were sourced from four hospitals in Al Najaf city. These hospitals include seven X-ray units. Patient demographic data are presented in table (2). From table (2), it is clear that the average patients' weight (kg) is ranged from 73±6.3 to 80.6±5.6 kg. The average patients' heights are ranged from 1.65±0.09 to 1.69±0.08 cm.

Table 2.

Weight (kg), height (m) and the BMI for patients examined for AP pelvis radiographic examination in this study.

Hospital code	Weight (kg) Average (SD)	Height (m) Average (SD)	BMI (kg/m^2) Average (SD)
ASTH	80.6(5.6)	1.69(0.08)	28.07(2.8)
AHGH (1)*	76.5(5.1)	1.69(0.10)	26.90(2.7)
AHGH (2)**	75.3(7.02)	1.66(0.08)	27.2(3.01)
AZH (1)	75.07(6.6)	1.65(0.10)	27.8(4.77)
AZH (2)	73.30(6.3)	1.65(0.09)	27.05(3.03)
AFAH(1)	79.00(5.5)	1.66(0.07)	28.5(3.20)
AFAH (2)	76.10(6.7)	1.67(0.07)	27.3(3.40)
BMI: Body mass index			

The BMI for all patients of this research is ranged from 27.05 to 28.07, this in turn indicates for a relative homogeneity of the sample size in term of the weight and length. Nevertheless, patients' weight (kg) and height (m) variations are expected due to the natural variability of the population of the current governorate. By contrast, the average weight (kg) of sample size considered in the UK was around 70 kg and this reflects the cultural variability of different population [6, 20].

The X-ray output values (mGy) normalized to 10 mAs for the seven X-ray units presented in table (3). From this table, it can be seen that the highest tube output was measured at AFAH (1) at 0.063 mGy/mAs and the lowest (0.031 mGy/mAs) was recorded at AZH- room (1).

Table 3.

This table lists the X-ray tube output factors measured at the seven X-ray units of the four hospital

Hospital code	X-ray tube output (mGy/mAs)
ASTH	0.041
AHGH (1)*	0.061
AHGH (2)**	0.046
AZH (1)	0.031
AZH (2)	0.040
AFAH(1)	0.063
AFAH (2)	0.053
* and ** represent the number of the room in a given hospital	

Tables (4) and (5) present the exposure factors applied to patients undergoing AP pelvis X-ray examinations and the corresponding ESD (mGy) calculated across the seven X-ray units. From table (4), it can be seen that that the minimum tube potential (kVp) used was at AHGH (2) with 73.07 kVp while the highest values was reported in ASTH at 87.3 kVp. The range of kVp reported in this study is comparable to those that reported in UK [6] (e.g. Average; 75 - Range 62-90 kVp).

Table 4.

This table presents the average and range values of the exposure factors (kVp, mAs and SID) applied for AP pelvic X-ray projection across the studied hospitals.

Hospital code	Tube potential (kVp)	Tube loading (mAs)	SID (cm)
ASTH	87.3(80-95)	13.6(12-16)	123.07(120-130)
AHGH (1)*	73.3(65-80)	30.9(24-40)	100.7(100-110)
AHGH (2)**	73.07(70-82)	32.15(24-40)	102.3(100-110)
AZH (1)	78.6(75-86)	28.9(19-40)	106.15(100-110)
AZH (2)	82(76-86)	35.38(22-46)	106.9(100-110)
AFAH(1)	80.6(80-82)	18.4(16-24)	100.0(100-100)
AFAH (2)	80.6(80-82)	19.3(16-24)	100.0(100-100)
* and ** represent the number of the room in a given hospital			

The minimum and the maximum tube loading (mAs) that were used for AP pelvis radiography is (13.6- 35.38 mAs). The current average values of the mAs are almost similar to those reported in literature [6-10]. The SID recorded for AP pelvis radiography is ranged from 100 cm 123 cm.

Patient ESD is presented in table (5). From this table, it can be seen that lowest ESD value was reported at ASTH with a value of 0.6 mGy, whereas the highest ESD value was reported at AHGA (1) with 4.14 mGy. The range of the average value of the ESD for AP pelvis examination across the seven units is from 0.81 mGy to 3.4 mGy.

Table 5.

This table presents, minimum, maximum, average and the standard deviation (SD) of the ESD (mGy) for pelvis X-ray examination across the studied hospitals.

Hospital code	Patient number	Minimum	Maximum	Average	±SD	Max/Min
ASTH	13	0.6	1.14	0.81	0.16	1.9
AHGH (1)*	13	2.68	4.14	3.4	0.36	1.54
AHGH (2)**	14	1.9	3.55	2.7	0.47	1.86
AZH (1)	13	0.89	2.48	1.66	0.52	2.7
AZH (2)	13	1.79	5.91	3	0.99	3.3
AFAH(1)	14	2.21	3.4	2.59	0.54	1.53
AFAH (2)	13	1.9	2.85	2.3	0.4	1.5
* and ** represent the number of the room in a given hospital; SD represents standard deviation						

Discussion

Monitoring the radiation dose for those patients undergoing routine radiographic X-ray examinations is of high importance from a radiation protection point of view. The latter argument is based on the fact that no safe dose ever no matter how small when considering the 'Linear No threshold Theory' (LNT). Therefore, attempts should be carried out to reduce the radiation dose and subsequently to reduce the patient radiation risk [21].

Examining the results of this work reveals that there was a clear variation in the calculated ESD whether among different hospitals or sometimes among the same hospital as evidenced by the SD (range: ±0. 0.16-±0.99). Another evidence for the dose variation is demonstrated by the data of the ratio of the maximum to minimum of the ESD (table 5). For example, the ratio of max/min of the ESD demonstrates that max value is around three times that of the minimum at AZH (2), while the lowest ratio is in AFAH (2) at 1.5 times. However, the range of the ratio of this study is lower than that reported for pelvis radiography in a previous study [22], while it is almost comparable to ratio of the max/min reported in [9].

By way of comparison, the results of ESD for AP pelvis demonstrate that the average ESD for the five out of seven of the X-ray units was higher than those reported by UNSCEAR report- 2010 [23] for AP pelvis using computed radiography imaging equipment (see figure 2). However, the results demonstrates that the patients doses were a almost lower than that reported by UK-surevy-2010 for six X-ray units out of seven ones except at one unit (i.e. AHGH (1)) where the ESD value was slightly higher than that reported in the UK [6]. High patient dose at AHGH (1) as compared to other local units and other international reported data on the doses could be attributed to the high mAs settings used together with high X-ray output (table 3).

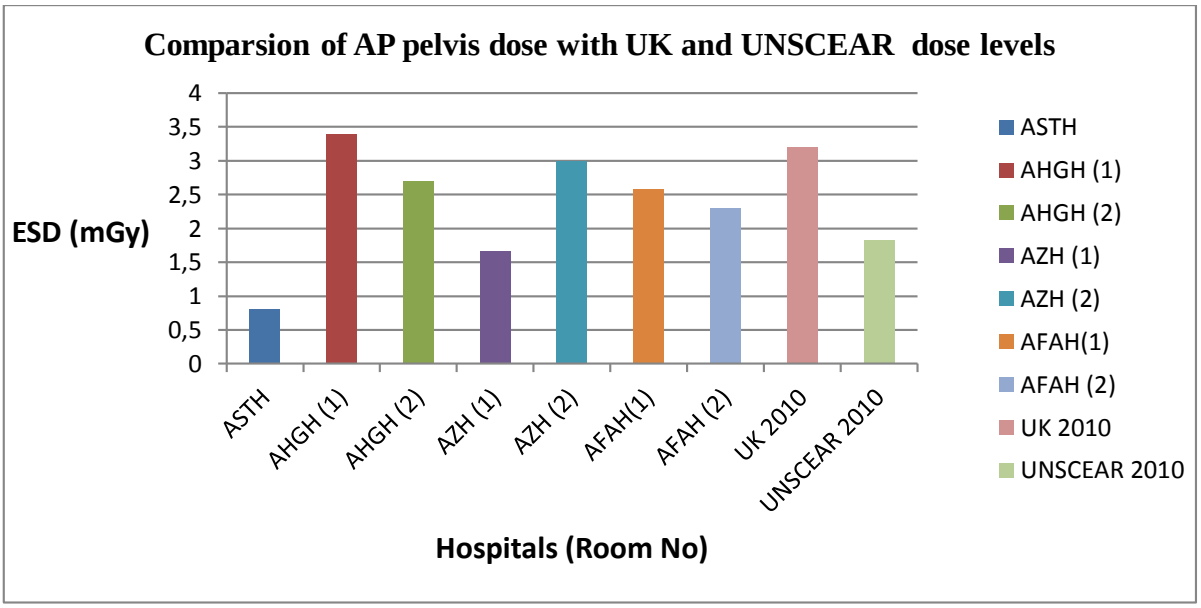

Figure 2. Comparison the ESD reported at the seven X-ray units with those doses reported by UK and UNSCEAR for AP pelvis.

On the other hand, comparing the doses obtained by this study with the patients' doses undergoing pelvis radiography of the neighboring countries and other developing countries reveals that in the Saudi Arabia [24], the dose was higher than the doses calculated in all the X-ray units considered in this study (e.g. 5.41 mGy). This could be due to the high mAs used in the Saudi Arabia study (e.g. 80 mAs). However, a recent study in Iran [25], the ESD of pelvis projection was reported to be lower than the doses calculated in six units out of seven and higher than one local unit (e.g. 1.47 mGy). Examining this case demonstrates that the Iranian hospitals are using approximately recommended level of the exposure factors together with achieving a regular quality control testing which our radiology departments may lack when compared with that of Iran. In a study conducted in Ghana (2014)[26], the AP pelvis ESD was reported to be considerably lower than the ESD obtained by the current study (i.e. 6 out of 7 units) by around 61% when compared with the highest ESD values reported in this study. This low dose level in Ghana can be clearly attributed to the low exposure settings adopted by Ghanaian operators.

However, another similar two studies conducted in Nepal and Ghana to assess the AP pelvis patients' dose in 2016 and 2013 respectively [8, 27] reveal that the ESD values were almost comparable to this study ESD except at two units in Ghana were the dose were extremely higher than this study and the international published levels [6, 23]. Finally, a recent study conducted in India in 2017 [28] demonstrates that ESD for pelvis radiography was higher than the ones calculated in this study (e.g. average ESD 4.33 mGy).

The variations exist in the ESD among different hospitals and sometimes among the same X-ray unit for the same X-ray examination is an issue that needs to be discussed [29]. The latter argument is based on the fact that the variability in the patient exposure should be reduced to a minimum level aiming to achieve the quality assurance/control goals within the diagnostic X-ray units. To achieve these goals, it is important to periodically assess the patient dose and then to find the measure of keeping it as low as reasonably possible [30]. In practice, there are a number of causes behind these variations. For instance, setting different exposure factors among different X-ray units for the same X-ray projection would lead to different radiation exposure [31]; operators with different experience levels may cause the variability in the radiographic practice; finally, patients' sizes and could also impose certain limitations that can be reflected on the patients dose consistency at different units [32].

Conclusion

The radiation dose was calculated for those patients undergoing AP pelvis radiographic examination at the main hospitals of Al Najaf city. According to the results, the average ESDs values were almost comparable to those reported in UK survey for the majority of Najaf X-ray units, and higher than that reported by UNSCEAR for CR technology. A clear variation in setting the exposure factors for this X-ray projection was identified. The results of this study can be used as a baseline for future dosimetry assessment. Finally, to ensure that the patient dose is kept at the controlled level, equipment quality control testing together with performing a training course for operators is highly recommended.

Acknowledgement

The authors would like to thank the staff of faculty of Sciences-University of Kufa for their support. Also, we would like to thank all the radiologists and the radiographers who are working in Al Najaf Major hospitals who have directly and indirectly contributed to the production of this paper.

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	JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 18.09.2018 **http://T-Science.org**

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SECTION 3. Nanotechnology. Physics

«NONLINTAR» MODEL OF TRIBOSYSTEMS EVOLUTION

Abstract: *A theoretical approach is presented to describe the parameters which characterize the friction interaction of solid bodies as well as the processes of selforganization at friction. Based on this approach, interconnections are established between mechanical and molecular-atomistic models of friction processes. A supposition is suggested about creation of a unified model of friction.*

Key words: *soliton, tribon, friction system, quantum mechanics.*

Language: *Russian*

Citation: Lyubimov B, Dolgopolov K (2018) «NONLINTAR» MODEL OF TRIBOSYSTEMS EVOLUTION. ISJ Theoretical & Applied Science, 09 (65): 53-58.

Soi: http://s-o-i.org/1.1/TAS-09-65-9 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.9

«НЕЛИНЕЙНАЯ» МОДЕЛЬ ЭВОЛЮЦИИ ТРИБОСИСТЕМ

Аннотация: *Представлен теоретический подход к описанию величин, характеризующих фрикционное взаимодействие твердых тел, а также процессов самоорганизации при трении. На основании предложенного подхода установлены взаимосвязи между механистической и молекулярно-атомистической моделями процессов трения. Высказано предположение о возможности создания единой модели трения.*

Ключевые слова: *солитон, трибон, трибосистема, квантовая механика.*

Работа выполнена при поддержке Российского научного фонда (проект №14-29-00116), организация ФГБОУ ВПО «Ростовский государственный университет путей сообщения», участник проекта Долгополов К.Н.

1. Введение

Современные тенденции к росту надежности машин при неизменном повышении энергоемкости их силовых установок и энергонапряженности процессов фрикционного взаимодействия материалов узлов трения приводят к расширению базы знаний о методах расчета теплофизических параметров конструкционных материалов, как основного критерия их трибостойкости. На сегодняшний день, в силу развития аппарата квантово-химических расчетов и химического моделирования процессов взаимодействия веществ, на первый план встает требование обеспечения заданной точности результатов вычислений при упрощении вычислительных систем и минимизации вычислительных ресурсов. Это может быть достигнуто путем применения полуэмпирических методов расчета энергии и структуры систем, достаточных для выполнения конструкторских изысканий. Облегчение такого рода расчетных задач возможно за счет формализации подхода к трению как к обмену квазичастицами, в результате чего формируется поле фрикционного взаимодействия, в плоскости которого и протекает эволюция трибосистемы.

2. Движение солитонов

Развитие представлений о микромеханизмах трения и изнашивания материалов требует применения современного аппарата физических теорий для их описания [1,2]. В конце прошлого века известный российский специалист по термодинамике и самоорганизации трибосистем А.А. Поляков писал: «В результате

формирования новой области физической кинетики неравновесных процессов на сцену выходит новый фактор – квантовая структура энергетических состояний атомов и молекул. Возникает необходимость детального учета квантовой структуры вещества, всего набора энергетических термов частиц и его временной эволюции» [3].

Следует различать понятия «узел трения», «трибосопряжение» и «трибосистема» [4]. Два первых являют собой ряд технических элементов, взаимосвязанных структурно и функционально [5]. Трибосистема «возникает» в результате фрикционного взаимодействия между этими элементами. Украинский триболог Л.И. Бершадский писал, что «...определение трибосистемы...относится не столько к терминологии, сколько является принципиальным вопросом строгой теоретической постановки трибологических задач. Естественное определение трибосистемы как динамической диссипативной системы состоит в том, что она представляет собой объект, в котором реализуется деградация энергии макромеханического движения(производится энтропия), т.е. включает трибовозбуждаемые объемы материалов, границу, открытую для потоков активируемых трением электричества, звука, вещества и т.п., и связи со средой (динамическую, температурную, электрохимическую и т.п.) [6]. Представление о трибосистеме оказываются тесным образом связанным с центральным понятием современной трибологии «третье тело» [7].

Генезис трибопроцессов можно свести к трем этапам, включающим рождение третьего тела, его функционирование и разрушение. Представление совокупности физико-химических изменений, происходящих в поверхностных слоях трибосопряжения в форме появления «третьего тела», представляющего собой единую физическую систему, позволяет отождествить понятие «третье тело» и «трибосистема», как продукт фрикционного взаимодействия отдельных динамически связанных элементов трибосопряжения. Концепция третьего тела в трибологии имеет ряд сходных моментов с представлениями о квазичастицах – понятия, применяемого в квантовых теориях твердого тела, конденсированных состояний вещества [8].

В модели квазичастиц процессы близкой физической природы заменялись рассмотрением одной квазичастицы, например, фонона при исследовании упругих колебаний в кристалле. В концепции «третьего тела» совокупность различных по природе взаимодействий заменяется одним мезоразмерным физическим объектом. «Третье тело», подобно виртуальным частицам, опосредовано проявляет себя в различных физических процессах, однако если виртуальные частицы – «невидимая реальность», то третье тело – это реальная абстракция, физическая модель, проявляющая себя в виде смазочных пленок, дислокационных ступенек, пластификации поверхностей трения и т.п. Третье тело –макроскопическое виртуальное квазифизическое образование, отражающее многообразие причинно-следственных связей, характеризующих процесс трения как «удивительный, не имеющий аналога природный феномен» [9].

Отождествление понятий трибосистемы и третьего тела имеет ряд важных следствий:

-во-первых, свойства трибосистемы определяются взаимодействием термодинамических потоков, о которых писал Л.И. Бершадский;

-во-вторых, в конечном счете, пусть опосредовано, но в трибосистеме заметно влияние квантовых корреляций [8,10], что делает необходимым привлечение для описания фрикционного взаимодействия аппарата и понятий квантовой механики;

-в-третьих, последовательный квантово-механический подход к описанию эволюции трибосистем, позволяет рассматривать данный процесс как проявление фундаментальных физических законов редукции волновой функции и декогеренции, что позволяет объяснить существующие парадоксы трибологии [10-14] (данный подход не противоречит принципу Оккама [15]).

Неисследованным на сегодняшний день является постдекогерентный период эволюции трибосистемы. Следуя определению трибосистемы, приведенному выше, ее характеристики обусловлены взаимодействием энергетических потоков, возникающих внутри динамически развивающихся структурных элементов трибосопряжения. Эти потоки описывались с помощью теории переноса, причиной которого в трибосопряжении являются возмущения, нарушающие термодинамическое равновесие в узле трения [16]. Для формалистического описания данных процессов используется математический аппарат нелинейной динамики [17, 18].

Согласно основным положением нелинейной динамики большинство подобных процессов можно рассматривать как движение особых физических объектов, получивших название «солитоны». Введение понятия «солитон» явилось важным развитием представлений о полевом строении материи, восходящем к работам А. Эйнштейна, М. Борна, Г. Ми и др. [19]. В частности, А. Эйнштейн считал, что все наблюдаемые частицы должны описываться как решение полевой модели единой

теории поля, над которой он работал всю жизнь. Он рассматривал нелинейные полевые модели в рамках принципа общей относительности, ориентируясь на проблему объединения теории гравитации и электромагнетизма. Г. Ми и развивший его идеи М. Борн рассматривали материальные частицы как полевые образования.

Солитон, находящийся в состоянии покоя, имеет как бы две составляющие его части: статическую – частицеподобную и динамическую –периодическую во времени часть, имеющую вид стоячей волны. Подобная полевая конфигурация, переходящая из состояния покоя в движение, формально означает проведение над уравнениями, описывающими солитон, преобразований Лоренца. При этом стоячая волна превращается в бегущую [19].

В работе [18] отмечалось, что «... развитие нелинейной динамики привело к открытию классических частицеподобных объектов – солитонов, описываемых лоренц-инвариантными уравнениями и имеющих непрерывный спектр скоростей $0 \leq \vartheta \leq \vartheta_s$, где ϑ_s – скорость звука». Движение солитонов сопровождается эффектами, связанными с конечной скоростью звука, аналогичным релятивистским эффектам специальной теории относительности. Среди этих эффектов – лоренцово сокращение ширины движущихся солитонов, изменение формы поля механических напряжений, лоренцова зависимость энергии солитона от скорости и т.п. Работы физиков-теоретиков Г.Ф. Глинского, Е. Плебанского и М. Новелло убедительно указывают на влияние нелинейных электромагнитных полей солитонов на изменение метрики пространства-времени(генерирование эффективной римановой метрики),приводящее к искривлениям световых лучей подобно тому, как это наблюдается в гравитационных полях, что сближает эффекты нелинейной электродинамики с общей теорией относительности [20,21]. Величина искажения пространства-времени находится в прямой зависимости от величины плотности энергии, в нем аккумулированной.

Наличие у солитона частицеподобной и волновой части делает его объектом дебройлевской квантовой природы, поскольку именно в солитонах наиболее ярко проявился феномен корпускулярно-волнового дуализма, легшего в основу квантовой теории материи. Поэтому подобно квантовым частицам солитоны обладают такой характеристикой, как спин, и полным набором соответствующих квантовых корреляций [8,19]. Применение законов квантовой механики к описанию солитонов столкнулось со сложностями, связанными с конечными размерами этих объектов. Частицы в квантовой механике характеризуются волновыми функциями, квадрат модуля которых определяет плотность вероятности обнаружения частицы в заданной точке пространства, что подразумевает представление частицы как точечного объекта. Солитон же имеет конечные размеры. Подобные конечномерные квантовые объекты, несущие на себе электрический заряд, были изучены крупными американскими физиками-теоретиками Дж. Уилером и Ч. Мизнером [22]. Они предложили рассматривать подобные частицы как области с измененной топологией пространства, обладающей значительной кривизной, что с точки зрения ОТО означает наличие в данной пространственной области значительной энергетической плотности. Частицы в интерпретации Уилера-Мизнера являются элементом измененной геометрической структуры физического пространства, рассматриваемого в форме гиперповерхностей, находящихся в четырехмерном пространстве-времени.

3. От солитона к трибону – путь к созданию единой теории трения

Математический аппарат, описывающий физическое поведение солитонов, в полной мере соответствует их дуальной квантовой природе, поэтому основные соотношения в теории солитонов имеют вид волновых уравнений Гордона или уравнения Шредингера [8, 16, 17]. В условиях трения энергетические потоки, формируемые внутри трибосистемы, можно рассматривать как движение «солитонов Хиггса» в некотором скалярном поле, описываемом полевой функцией Φ и потенциалом $V(\Phi)$ (подчиняющееся волновому уравнению вида синус-Гордона) [18,23].

Плотность импульса такого солитона определяется как $p = -\Phi\nabla\Phi$, где ∇–оператор Пуассона. В модели Хиггса движение в скалярном поле можно рассматривать как одномерное$\Phi = \Phi(t; x)$, т.е. описываемое уравнением [23]:

$$\frac{\partial^2\Phi}{\partial t^2} - \frac{\partial^2\Phi}{\partial x^2} = m^2\phi - \lambda\phi^2, \qquad (1)$$

где m и λ – постоянные интегрирования.

Если представить, что солитон перемещается в пространстве с некоторой относительной скоростью u по траектории $x = x_0 + ut$, то полевую функцию $\Phi(t; x)$ целесообразно представить в виде $f(x–ut)$, что приводит к следующей форме уравнения движения:

$$\frac{1}{\gamma^2} f'' = f - f^3, \qquad (2)$$

$$\gamma = \frac{1}{\sqrt{1-u^2}},$$

где u – отношение скорости солитона к скорости звука.

Коэффициент γ в уравнении (2) подчеркивает лоренц-инвариантность уравнений, описывающих движение солитонов Хиггса, примером которых являются, например, дислокационные потоки. То, что движение быстрых дислокаций описывается уравнениями специальной теории относительности (СТО), было показано в середине 20 века южноамериканским физиком Дж. Кульман-Вильсдорф, которая считала, что лоренц-инвариантность в данном случае не является формальным совпадением уравнений, описывающих движение дислокаций и формул СТО, а отражает факт действия законов релятивистской физики [24]. Развитие нелинейной динамики подтвердило предположения Кульман-Вильсдорф и предопределило зарождение одной из областей трибофизики – триборелятивизма [8, 25]. Особое влияние триборелятивистские эффекты оказывают на трибохимические процессы, что связано с зависимостями энергии и собственного времени физических объектов от скорости их движения и, соответственно – значения параметра γ из уравнения (2). То, что такие временные изменения внутри трибосистем реально наблюдаются, подтверждено серией опытов, аналогичных оптическим экспериментам Г. Айвса [26], в которых при помощи доплеровского смещения оптического излучения было обнаружено замедление течения времени, предсказанное СТО. Эффекты, аналогичные обнаруженным Айвсом, были исследованы при прохождении лазерного пучка через фрикционный контакт [20, 27]. Вклад со стороны сил трения во временной сдвиг составляет 2 микросекунды за 1 секунду. Подобные временные отрезки оказываются больше, чем характерные времена химического взаимодействия, что подтверждает вклад триборелятивистских эффектов в течение трибохимических реакций.

«Одномерный» вид уравнения движения (1) облегчает рассмотрение термодинамической эволюции трибосистемы. При переходе к одномерному приближению солитонов Хиггса скорость изменения энтропии может быть записана в виде:

$$\frac{dS}{dt} = \frac{1}{T^2}\frac{\partial}{\partial z}\Omega\left(Q, \mu_к\right), \qquad (3)$$

где S – энтропия, t – время, T – температура, Q – тепловой поток, $\mu_к$ – химический потенциал, Ω – обобщенная термодинамическая функция.

Обобщенная термодинамическая функция может быть выражена через тепловые параметры:

$$\Omega = \frac{\pi\lambda}{2}T^2z^2, \qquad (4)$$

где λ – коэффициент теплопроводности среды, T – температура среды, z – линейные размеры среды.

Если температуру T выразить через параметры фрикционного взаимодействия в исследуемой трибосистеме с использованием закона теплопередачи Ньютона, то получим следующее выражение:

$$T = \frac{fN\vartheta}{\pi\lambda z},$$

приводящее к изменению выражения (4):

$$\Omega = \frac{1}{2}\frac{f^2N^2\vartheta^2}{\pi\lambda} = \frac{1}{2}\frac{F_{mp}^2\vartheta^2}{\pi\lambda} = \frac{1}{2\pi\lambda}P_{\text{тр}}^2, \qquad (5)$$

где $f_{\text{тр}}$ – коэффициент трения, N – нормальная нагрузка, ϑ – скорость скольжения, $F_{\text{тр}}$ – сила трения, $P_{\text{тр}}$ – мощность, развиваемая силами трения.

Выражение (5) для функции Ω делает данную величину схожей с диссипативной функцией. Эта связь усиливается при записи выражения (3) через мощность трения:

$$\frac{dS}{dt} = \frac{1}{\pi\lambda z}\left(\frac{P_{mp}}{T}\right)^2. \qquad (6)$$

Отношение мощности трения к температуре можно рассматривать по аналогии с классической термодинамикой как «приведенную мощность трения». Соответственно скорость изменения энтропии трибосистемы оказывается пропорциональной этой величине. Полученные соотношения, связывающие линейной зависимостью термодинамические характеристики трибосистемы и мощность трения, которая может быть измерена с достаточной точностью, возможно, открывают путь к новым способам трибомониторинга, в которых на смену силовым характеристикам фрикционного взаимодействия придут энергетические.

Анализ выражения (6), связывающего количественную характеристику воспроизведения энтропии трибосистемы с приведенной мощностью трения, предполагает ее уменьшение в процессе самоорганизации. Следствием процессов самоорганизации служит улучшение антифрикционных характеристик узла трения, происходящие благодаря формированию смазывающих пленок, экранирующих тепловые потоки на поверхности трения.

Упрощение выражений, характеризующих кинетику изменения термодинамических параметров трибосистемы и её энергетических характеристик до вида (5) и (6), открывает дополнительные возможности в развитии квантово-механических моделей фрикционного взаимодействия. В основе квантово-механических представлений может быть положена гипотеза, высказанная Л.И. Бершадским [20] и получившая развитие в работах [8, 30].

Гипотеза строится на применении к описанию фрикционного взаимодействия представления об обменных силах, введенных в квантовую физику нобелевским лауреатом Р. Фейнманом [31]. В соответствии с этой гипотезой предлагается рассматривать силу трения как результат обмена между поверхностями трибосопряжения квазичастицами «трибонами», представляющими собой кванты трения [20]. Генерирование трибонов осуществляется в контакте шероховатостей трущихся тел, а поскольку силы трения оказывают влияние сразу на обе поверхности фрикционного контакта, то можно допустить, что за единичный акт фрикционного взаимодействия двух микронеровностей рождается два одинаковых трибона – по одному на каждую поверхность. Данное предположение получило доказательство в работе [8]. В рамках развиваемых концепций трибон может рассматриваться как «элементарный солитон». Энергетические параметры, характеризующие фрикционное взаимодействие в трибосопряжении, можно представить в виде суммы физических характеристик, соответствующих отдельным трибонам, число и энергия которых в соответствии с результатами, приведенными в работах [8, 30], поддаются оценкам.

В работах [8, 30] было показано, что количество генерируемых силами трения трибонов пропорционально величине фактического давления, фактической площади контакта. В процессе фрикционного взаимодействия поверхностей трения наблюдается сглаживание шероховатостей, приводящее к уменьшению величины фактического давления, а, следовательно, к уменьшению числа трибонов, порождаемых трением. Снижение интенсивности генерирования трибонов, числом которых определяется величина мощности трения (6), характеризует завершение приработки и перехода узла трения к установившемуся режиму изнашивания [31] с минимальной скоростью прироста энтропии. В соответствии с основными принципами термодинамики данный процесс означает структурное усложнение трибосистемы как результат ее самоорганизации, по представлениям А.А. Полякова [3,16].

Заключение

Подход, основанный на элементах нелинейной динамики и квантово-обменной модели, позволяет с единых позиций описывать механистический аспект представления сил трения и усложнение структуры трибосистемы, определяемое законами термодинамики. Применяемые принципы дают возможность усовершенствовать полуэмпирические методы расчета энергии, структуры, свойств трибосистемы, облегчив задачи моделирования трибопроцессов при разработке новых конструкционных материалов. Предложенный подход, являясь развитием «атомарно-молекулярных» моделей трения, позволяет ближе подойти к созданию единой трибологической доктрины.

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Impact Factor:			
ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 19.09.2018 **http://T-Science.org**

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SECTION 20. Medicine

INDICATORS OF THE PSYCHOEMOTIONAL SPHERE OF STUDENTS OF THE MEDICAL PROFILE WITH EXISTENCE OF THE INTERNET ADDICTION

Abstract: *Indicators of the psychoemotional sphere at the students with internet addiction studying at medical faculty are surveyed. Over 40% of addicts have the high level of reactive and personal uneasiness (meets at the female faces of those persons more). Among the above-stated category of surveyed cases of a slight depression (more often at a male) and a subdepression are registered. The vast majority of addictional students (over 70%), both young men, and girls, possess the inadequate self-rating which is (generally underestimated). The high level of the general aggression reflecting low adaptive opportunities, and introversive orientation of the person at female addicts become perceptible more often.*

Key words: *students, internet addiction, psychoemotional sphere, young men, girls.*

Language: *Russian*

Citation: Gorbyleva KV (2018) INDICATORS OF THE PSYCHOEMOTIONAL SPHERE OF STUDENTS OF THE MEDICAL PROFILE WITH EXISTENCE OF THE INTERNET ADDICTION. ISJ Theoretical & Applied Science, 09 (65): 59-62.

Soi: http://s-o-i.org/1.1/TAS-09-65-10 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.10

ПОКАЗАТЕЛИ ПСИХОЭМОЦИОНАЛЬНОЙ СФЕРЫ СТУДЕНТОВ МЕДИЦИНСКОГО ПРОФИЛЯ С НАЛИЧИЕМ ИНТЕРНЕТ-АДДИКЦИИ

Аннотация: *Рассмотрены показатели психоэмоциональной сферы у студентов с интернет-зависимостью, обучающихся на медицинском факультете. Свыше 40% аддиктов имеют высокий уровень реактивной и личностной тревожности (у лиц женского пола таковых лиц встречается больше). Среди вышеуказанной категории обследуемых регистрируются случаи легкой депрессии (чаще у мужского пола) и субдепрессивного состояния. Подавляющее большинство зависимых студентов (свыше 70%), как юношей, так и девушек, обладают неадекватной самооценкой (в основном заниженной). Высокий уровень общей агрессии, отражающий низкие адаптивные возможности, и интровертированная направленность личности у аддиктов женского пола отмечаются чаще.*

Ключевые слова: *студенты, интернет-зависимость, психоэмоциональная сфера, юноши, девушки.*

Введение.

Нынешняя ситуация, связанная с лавинообразным развитием интернет-ресурсов и внедрением их практически во все сферы деятельности человека, привела к тому, что участились случаи чрезмерного увлечения глобальной сетью, достигающие болезненного пристрастия [1, с. 232-239], которое оказывает негативное воздействие на психоэмоциональную сферу и межличностные отношения [2, с. 32-35].

Исследование тенденций формирования интернет-зависимости у студентов медицинского университета показывает, что их большинство тратит достаточно времени на виртуальные развлечения и это непременно отражается на их успеваемости, состоянии здоровья, в том числе психического, приводя к изменениям в коммуникативной сфере [3, с. 134], создавая угрозу потери социальных отношений в связи с частым использованием Всемирной Сети [4, с. 92].

Авторами выявлено, что эмоционально-волевая сфера интернет-зависимого студенческого контингента характеризуется высокими параметрами личностной тревожности, депрессии, агрессивности, враждебности и

низкими показателями силы воли, стрессоустойчивости, самооценки, уверенности в себе [5, с. 123]. Студенты, проводящие много времени в сети, имеют достоверно более высокий уровень пессимизма, ригидности и низкий – оптимизма, склонны к снижению активности и контактов с людьми [6, с. 16]. Ведущими характеристиками в структуре личности интернет-аддиктов можно считать замедление темпов личностного роста и саморазвития, слабое осознание жизненных целей и перспектив, недооценку собственного потенциала в преодолении жизненных препятствий [7, с. 126-127].

Цель исследования.

Изучение показателей психоэмоциональной сферы студентов медицинского профиля с наличием интернет-аддикции.

Материалы и методы.

Исследования выполнялись в Лаборатории оптимизации учебного процесса кафедры нормальной физиологии Кыргызско-Российского Славянского университета. С целью выявления интернет-зависимости обследованы студенты младших курсов (юноши – n=171, девушки – n=271) в возрасте 18-20 лет, обучающиеся на медицинском факультете, с использованием опросника Чена, согласно которому выделяются следующие шкалы: 1) Com (компульсивные симптомы); 2) Wit (симптомы отмены); 3) Tol (симптомы толерантности); 4) IH (внутриличностные проблемы и проблемы со здоровьем); TM (проблемы с управлением временем), по каждой из них суммируются все пункты и далее выводится общий CIAS балл = Com + Wit + Tol + IH + TM [8, с. 30-33]. На следующем этапе проведен анализ показателей психоэмоциональной сферы лиц, имеющих аддикцию (юноши – n=24, девушки – n=23) с применением следующих опросников:

1) Спилбергера-Ханина для исследования уровня тревожности [9, с. 32-33], который является надёжным и информативным способом самооценки уровня тревожности в данный момент (реактивная тревожность как состояние), личностной тревожности (как устойчивой характеристики психики человека);

2) Цунга в целях выявления депрессии [9, с. 34-35], применяющийся с целью дифференциальной диагностики депрессивных состояний и состояний, близких к депрессии, для скрининг-диагностики при массовых обследованиях и в целях предварительной доврачебной диагностики. Опросник состоит из 20 утверждений, содержащих определённые симптомы депрессии. Представленность этих симптомов нужно оценить по шкале: крайне редко, редко, часто, большую часть времени или постоянно;

3) Л.Г. Почебут для диагностики агрессивного поведения [10, с. 383-385] по 5 шкалам:

1. вербальная агрессия (ВА) – человек вербально выражает свое агрессивное отношение к другому человеку, использует словесные оскорбления;

2. физическая агрессия (ФА) – человек выражает свою агрессию по отношению к другому с применением физической силы;

3. предметная агрессия (ПА) – человек срывает свою агрессию на окружающих его предметах;

4. эмоциональная агрессия (ЭА) – у человека возникает эмоциональное отчуждение при общении с другим человеком, сопровождаемое подозрительностью, враждебностью, неприязнью или недоброжелательностью по отношению к нему;

5. самоагрессия (СА) – человек не находится в мире и согласии с собой; у него отсутствуют или ослаблены механизмы психологической защиты, он оказывается беззащитным в агрессивной среде;

4) С.В Ковалёва для определения уровня самооценки, в котором исследуемому предлагаются 32 суждения, а он, выражая степень своего согласия, оценивает их, выбирая один из вариантов ответа, каждый из которых соответствует определенному количеству баллов: 4 – очень часто; 3 – часто; 2 – иногда; 1 – редко; 0 – никогда;

5) К. Юнга для установления типа личности.

Результаты и обсуждение.

Выявление интернет-зависимых лиц показало, что 15,2% юношей имеют аддикцию, 38% - склонны к подобному состоянию, а у 46,8% она не обнаружена. Данные девушек выглядят так: у 11,4% можно констатировать наличие зависимости, 38% её не имеют, 50,6% находятся на доаддиктивном этапе. В ходе оценки уровня реактивной тревожности у обследуемых мужского пола с аддикцией обнаружено, что 12,5% имеют её низкие значения, 45,8% – умеренные и 41,7% – высокие, в то время как у аналогичных лиц женского пола низкий уровень регистрируется в 8,7% случаев, умеренный – 34,8%, а высокий – 56,5%. Что касается личностной тревожности, то ситуация у представителей вышеуказанных групп выглядит почти идентично, а именно: высокие параметры встречаются у 41,7% юношей и 47,8% девушек, умеренные – 41,7% и 39,1% соответственно, низкие – 16,6 % против 13,1% случаев. Показатели двух видов тревожности,

выраженные в баллах, между аддиктами обоего пола достоверно не отличаются (табл. 1).

Таблица 1

Уровень тревожности, депрессии и самооценки у юношей и девушек с интернет-аддикцией

Уровень в баллах	Юноши n= 24	Девушки n=23
Реактивная тревожность	41,7±2,1	46,3±2,5
Личностная тревожность	42,7±2,5	42,4±2,7
Депрессия	40,3±2,04	38,1±1,9
Самооценка	54,25±3,7	53,6±5,6

Рассматривая значения уровня депрессии среди интернет-зависимых лиц, стоит отметить, что в обеих группах выявлены случаи легкой депрессии (в 3 раза чаще встречающиеся у юношей – 12,5% против 4,3%) и субдепрессивного состояния (4,2% и 4,3% соотвественно). Параметры в баллах практически схожи (табл. 1). Говоря об уровне самооценки, можно выделить следующие особенности: адекватные её значения имеет только ¼ часть обследуемых (25 % юношей и 22,7% девушек), подавляющее же большинство характеризуется ее низким уровнем (66,7% и 63,6% соответственно) и у небольшой группы она высокая (среди 8,3% юношей и 13,7% девушек). При сравнении балльных значений показателя самооценки достоверных различий не обнаружено (табл. 1).

Таблица 2

Уровень агрессии у юношей и девушек с интернет-аддикцией

Уровень агрессии в баллах	Юноши n= 24	Девушки n=23
Вербальная	2,75±0,3	3,2±0,4
Физическая	4,04±0,36	2,7±0,4*
Предметная	2,8±0,3	4±0,4*
Эмоциональная	2,4±0,3	2,2±0,3
Самоагрессия	3,4±0,5	3,26±0,4
Общая	15,2±1,1	15,3±1,3

Примечание: показатель статистически достоверен при: * P<0,05.

При оценке агрессивного поведения обнаружено, что значения предметной агрессии, выраженные в баллах (табл. 2), достоверно выше у интернет-зависимых девушек по сравнению с таковыми юношами (4±0,4 и 2,8±0,3 соответственно), а физической – у последних (4±0,36 против 2,7±0,4). Высокий уровень общей агрессии, демонстрирующий низкие адаптивные возможности, чаще встречается у аддиктов женского пола (8,7% против 4,2%), а самоагрессии – у мужского (25% и 17,4% соответственно). Исследование типа личности показал, что практически половина интернет-зависимых девушек являются амбивертами (45,5%), 31,8% обследуемых приходится на экстравертов, в то время как у юношей ситуация выглядит несколько иначе: 70,9% относятся к амбивертам, 20,8% – к экстравертам, а вот интровертированная направленность личности у девушек-аддиктов выявлена почти в 3 раза чаще (22,7% против 8,3%).

Выводы.

Таким образом, анализ психоэмоциональной сферы интернет-зависимых студентов медицинского профиля позволил выделить своего рода контуры лиц, относящихся к данному контингенту, который независимо от пола, достаточно тревожен, депрессивен, имеет низкую самооценку, старается находиться в своем собственном виртуальном мире и меньше контактировать с окружающими. Полученные данные являются одним из фрагментов, составляющих сложную мозаику личностных изменений аддикта, и требуют дальнейшего изучения. Результаты проведенного исследования указывают на необходимость разработки плана коррекционных и профилактических мероприятий.

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Impact Factor:	ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 19.09.2018 **http://T-Science.org**

SECTION 2. Applied mathematics. Mathematical modeling.

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ADVANCED MATHEMATICAL MODEL OF THE PROCESS OF FINE-DISPERSED PARTICLES DISTRIBUTION IN THE ATMOSPHERE

Abstract: *The paper considers the urgent task related to monitoring and forecasting the ecological state of the surface layer of the atmosphere in industrial regions with the aim of maintaining a balance of the sanitary norm. The review of scientific works on the development of mathematical models, numerical methods and their software for carrying out a complex study of transport processes, diffusion and transport of aerosol particles and exhaust gases in the atmosphere is reviewed. The developed mathematical model of the process of transport and diffusion of aerosol particles in the atmosphere is considered, which takes into account the essential parameters of the research object: the velocity of the particles of aerosol emissions in the atmosphere, which depends on the mass and radius of the particles; acceleration of free falling of particles; coefficient of the drag of particles during their transfer by air mass; body shape factor for calculating the drag force; air flow lift; the density of particles and air, as well as the viscosity of air.*

Key words: *mathematical model, transport, diffusion, harmful substances, weather and climate factors, hydromechanics, fine particles.*

Language: *Russian*

Citation: Ravshanov Z, Tashtemirova N, Mukhamadiev A (2018) ADVANCED MATHEMATICAL MODEL OF THE PROCESS OF FINE-DISPERSED PARTICLES DISTRIBUTION IN THE ATMOSPHERE. ISJ Theoretical & Applied Science, 09 (65): 63-69.

Soi: http://s-o-i.org/1.1/TAS-09-65-11 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.11

УСОВЕРШЕСТВОВАННАЯ МАТЕМАТИЧЕСКАЯ МОДЕЛЬ ПРОЦЕССА РАСПРОСТРАНЕНИЯ МЕЛКОДИСПЕРСНЫХ ЧАСТИЦ В АТМОСФЕРЕ

Аннотация: *В работе рассматривается актуальная задача, связанная с мониторингом и прогнозированием экологического состояния приземного слоя атмосферы промышленных регионов с целью сохранения баланса санитарной нормы. Приведен обзор научных работ по разработке математических моделей, численных методов и их программного обеспечения для проведения комплексного исследования процессов переноса, диффузии и транспорта аэрозольных частиц и выбросных газов в атмосфере. Рассматривается разработанная математическая модель процесса переноса и диффузии аэрозольных частиц в атмосфере, в которой учтены существенные параметры объекта исследования: скорость перемещения частиц аэрозольных выбросов в атмосфере, зависящая от массы и радиуса частиц; ускорение свободного падения частиц; коэффициент лобового сопротивления частиц при переносе их воздушной массой; коэффициент формы тела для вычисления силы сопротивления; подъемная сила воздушного потока; плотность частиц и воздуха, а также вязкость воздуха.*

Ключевые слова: *математическая модель, перенос, диффузия, вредные вещества, погодно-климатические факторы, гидромеханика, мелкодисперсные частицы.*

Введение

Вопросы мониторинга, прогнозирования и оценки загрязнения атмосферы и подстилающей поверхности земли пассивными и активными примесями, мелкодисперсными частицами и углекислыми газами, а также вопросы проектирования и размещения промышленных объектов с соблюдением предельно допустимых

санитарных норм для промышленных регионов составляют собой одну из актуальных проблем в области охраны окружающей среды.

Анализ состояния окружающей среды за последние годы показал, что большой рост выброса вредных веществ в атмосфере привел к дисбалансу экологического состояния отдельных регионов. Это особенно заметно в государствах, где имеет место высокий темп развития промышленности, например, Китай, Россия, Индия, США, Франция, Великобритания, Япония, Северная Корея, Малайзия и др.

Негативные последствия возникают за счет увеличения загазованности атмосферы и концентрации вредных мелкодисперсных частиц, отрицательно воздействуя на живую систему – флору и фауну регионов, а на глобальном уровне вносят лепту в изменение климата земного шара.

Надо отметить, что для комплексного исследования указанной проблемы необходимо создание конструктивной системной методологии математического моделирования, использование которой даст возможность проведения мониторинга и прогнозирования экологического состояния промышленных регионов с целью предотвращения опасных техногенных последствий и принятия правильных управленческих решений.

Обзор литературы

Научные исследования, направленные на разработку математических моделей и вычислительных алгоритмов для систем мониторинга и прогнозирования загрязнения атмосферы промышленных регионов, проводятся в передовых научных центрах и высших учебных заведениях мира, в число которых входят Karlsruhe Institute of Technology, Institute of Applied Geosciences (Германия), Centre for Ecology and Hydrology, Centre for Water Science (Великобритания), Finnish Meteorological Institute (Финляндия), National Institute of Hydrology, Waterloo Hydro Geologic (Индия), Институт атмосферы физики им. А.М. Обузова, Институт вычислительной математики и математической геофизики (Россия), Научно-исследовательский и проектно-технологический институт «Атмосфера», Национальный университет Узбекистана, Ташкентский университет информационных технологий (Узбекистан) и других.

В частности, проблемой математического моделирования процессов переноса, диффузии и транспорта вредных веществ (углекислые газы, мелкодисперсные аэрозольные пассивные и активные частиц) занимаются научные школы, созданные под руководством Г.И. Марчука, В.В. Пененко, А.Е. Алояна, Л.Т. Матвеева, В.П. Дымникова И.Э. Нааца, Э.А. Закарина, И.А. Кибеля, Л.Н. Гутмана, Ф.Б. Абуталиева, а также зарубежных ученых W.J. Layton, J.H. Ferziger, J.W. Deardorff, M. Germano, U. Piomelli, L.C. Berselli, G.S. Winckelmans, W.C. Reynolds, X. Зидиск, К.А. Велдс, К.И. Наппо, Ж. Готаас, М. Мюллиоланд, С. Трап, М. Матиес, В. Эдельман и др.

Фундаментальные аспекты методологии математического моделирования процесса переноса и диффузии вредных мелкодисперсных частиц и углекислых газов в атмосфере сформулированы в работах М.Е. Берлянда, Е.Л. Гениховича, Р.И. Оникула, Н.Л. Бызовой, Ю.А. Анохиной, А.Х. Остромогильского, T Iversen., T.E. Nordeng, R.Lange, M Pekar., академика С.А. Солодкова и др.

Разработкой автоматизированных систем экологического мониторинга и прогнозирования состояния окружающей среды занимаются проф. Г.В. Аверин, А.А. Любимов, В.Ю. Волков, Ю.Д. Эдельштейн, В.В. Бугровский, А.М. Погорелов, А.В. Бизикин и др.

В работах М.Л. Арушанова и его учеников проведены подробные исследования, связанные процессами выноса соле-пылевых частиц из осушенной части Аральского региона и показано, на сколько изменяется климат региона вследствие воздействия выше указанного фактора [1-4]. Воздействие арозолей на климатические характеристики классифицировано следующим образом:

- увеличение температуры поверхности поглощающими аэрозолями;
- снижение температуры поверхности рассеивающими аэрозолями;
- уменьшение температуры поверхности вследствие увеличения количества облаков и поглощения ими прямой радиации;
- увеличение количества и продолжительности (вследствие задержки выпадения осадков) облачного покрова при больших концентрациях водорастворимого аэрозоля;
- увеличение количества осадков при небольших, но достаточных для образования крупных капель, концентрациях грубодисперсного аэрозоля (гигантских ядер конденсации).

Диссертация Пушилина Ю.Н. [5] посвящена проблеме математического моделирования процессов загрязнения атмосферы и решению таких задач, как прогнозирование, размещение постов для мониторинга (стационарных и мобильных), оценка вклада конкретного промышленного объекта в общее загрязнение воздуха в реальном времени с целью принятия управленческих мер по нормированию выбросов.

В статье [6] разработана модель 3D CFD для исследования процесса распространения мелкодисперсных аэрозольных частиц в

атмосфере. Математическая модель основана на модели транспортного градиента. В работе приводятся подробный анализ результатов проведенных численных расчетов на ЭВМ и выводы связанные с ним.

В диссертационной работе Серёгина О.В. [7] разработаны математические модели поглощения атмосферного кислорода, валовых выбросов углекислого газа и радона в приземный слой атмосферы, отличающиеся тем, что учтено влияние протяженных газоотдающих поверхностей, контактирующих с вентиляционными струями и аэрогазодинамических характеристик очистных и подготовительных участков. Усовершенствована методика инвентаризации источников пылегазовых выбросов от угольных шахт Подмосковного бассейна, а также разработан комплекс программных средств, позволяющий автоматизировать процесс расчета пылегазовых выбросов в приземные слои атмосферы от источников поверхностного технологического комплекса угольных шахт, проводить вычислительные эксперименты при моделировании различных геоэкологических и геотехнологических условий.

В статье [8] разработана динамическая многомерная математическая модель тепломассопереноса вредных примесей и теплоты в производственной среде с активной вентиляцией и источниками загрязнения, которая в отличие от существующих моделей распространения производственных вредностей позволяет учитывать завихрения газо-воздушных потоков.

В работе [9] описан новый алгоритм извлечения полного содержания атмосферных тонкодисперсных частиц (частиц размером менее 1,0 и 2,5 мкм) из мультиспектральных спутниковых изображений в видимой и ИК-областях электромагнитного спектра. Алгоритм основан на регрессионных соотношениях между отражательной способностью верхней поверхности атмосферы, микрофизическими параметрами аэрозоля и геометрическими параметрами спутниковой сцены. Предлагаемый алгоритм реализован и протестирован для спутникового прибора MERIS (среднее разрешение изображения).

В работе [10] предлагается двухмерная модель адсорбции следовых атмосферных составляющих аэрозольных частиц в воздухе, выброшенные промышленным источником. Модель основана на применении теории турбулентной диффузии в пограничном слое атмосферы в сочетании с моделью дисперсии вредных газов и моделью адсорбции газа пористыми твердыми частицами. Профили скорости ветра, используемые в симуляциях, были установлены по данным, ранее полученных в полевых условиях авторами статьи в Северном Негрееве (Израиль). Разработанная модель позволяет анализировать пространственную и временную эволюцию концентрации адсорбента в газовой фазе, а также в твердых частицах.

Распределение концентрации адсорбента рассчитывается для твердых частиц PM2.5-10, что типично для промышленных выбросов. Анализ проводится для различных метеорологических условий и классов устойчивости атмосферы. Показано, что концентрация газов, адсорбированных аэрозольным плюмом, сильно зависит от уровня атмосферной турбулентности. Полученные результаты сравниваются с имеющимися экспериментальными данными.

В работе [11] использованы модель COSMO-ART для прогноза концентраций загрязняющих веществ в атмосфере. Как отмечают авторы статьи система КОСМО-Ru7-АРТ способна адекватно смоделировать значение концентрации примесей в атмосфере. Система включает в себя модуль оценки выбросов загрязняющих веществ в атмосферу из лесных пожаров, который был успешно протестирован на случае лесных пожаров, произошедших летом 2010 года для европейской части России. В статье показано, что точный прогноз концентрации загрязняющих веществ оказывает положительное влияние на прогноз температуры воздуха из-за учета аэрозольной обратной связи на излучение.

В работе [12] получено точное аналитическое решение уравнения адвекции-диффузии, предполагающее параметризацию турбулентности для гауссовской дисперсии загрязнения и учет очистки осадков аэрозолями дождем. Влияние распределения размеров капель дождя было учтено с помощью метода Монте-Карло. Как отмечают авторы работы, предложенный подход позволяет анализировать пространственную и временную эволюцию концентрации аэрозоля в газовой фазе, а также в дождевых каплях. В работе получены явное аналитическое выражение, которое позволяет анализировать зависимость скорости аэрозолей ниже облака, абсорбирующих от гауссовых плюсовых выбросов воздуха по разным параметрам и обнаружено, что максимальная концентрация аэрозолей на уровне земли зависит от интенсивности осадков, а местоположение максимума приближается к источнику излучения, когда интенсивность осадков увеличивается. Сравнение предсказаний теоретической модели с экспериментальными данными, показало довольно хорошее согласие между теоретическими результатами и экспериментами. Как отмечают авторы статьи, полученные результаты могут быть полезны при анализе

различных моделей метеорологии и химии, включая очистку аэрозолей в пламени загрязнения воздуха до дождя и оценку воздействия на человека различных химических, биологических и радиологических загрязнителей.

Проведенный анализ выше указанных работ показали, что при математическом моделировании процесса переноса и диффузии вредных веществ в атмосфере не рассмотрены с учетом следующих основных факторов, которые существенно воздействуют на объект исследования:

- при процессе переноса и диффузии вредных веществ в атмосфере не рассмотрен транспорт аэрозольных частиц через границы области решения как третья краевая задача;
- при математическом моделировании процесса в всех работах коэффициент поглощения вредных веществ в атмосфере, который должен изменятся со временем, брался постоянным;
- не учитывалась орографическая поверхность земли, которая играет существенную роль в процессе распространения аэрозольных частиц в атмосфере;
- не учитывались погодно-климатические факторы в реальном масштабе времени;
- во всех разработанных математических моделях процесса скорость и направление ветра брались постоянными, а анализ метрологических данных показал, что в среднем за сутки направление ветра и скорость изменялись 12-13 раз;
- в математических моделях процесса при переносе частиц задавались скорость воздушного потока в атмосфере, а не скорости перемещения частиц, а коэффициент взаимодействия с подстилающей поверхностью задавался постоянным, в то время, когда он зависит от физико-механических свойств поверхности земли;
- в математических постановках задачи скорость осаждения частиц задавалась как постоянная константа, она не изменялась со временем и в зависимости от размеров и формы частиц.

Постановка задачи

Для разработки адекватной математической модели процесса переноса и диффузии аэрозольных выбросов в атмосфере, где учитывается скорость перемещения частиц под действием скорости ветра в пограничном слое атмосферы, рассмотрим полное уравнение гидродинамики

$$\frac{\partial\theta}{\partial t}+u\frac{\partial\theta}{\partial x}+v\frac{\partial\theta}{\partial y}+(w-w_g)\frac{\partial\theta}{\partial z}+\sigma\theta=$$
$$=\mu\left(\frac{\partial^2\theta}{\partial x^2}+\frac{\partial^2\theta}{\partial y^2}\right)+\frac{\partial}{\partial z}(k(z)\frac{\partial\theta}{\partial z})+ \quad (1)$$
$$+\delta Q(x,y,z,t);$$

$$\left.\begin{aligned} m\frac{du}{dt}&=c_f\pi r^2\rho_в(u-U)^2;\\ m\frac{dv}{dt}&=c_f\pi r^2\rho_в(v-U)^2;\\ m\frac{dw_g}{dt}&=-\frac{4}{3}\pi r^3(\rho_n-\rho_в)g-\\ &\quad -k_f\mu_в\pi r w_g+F_n \end{aligned}\right\} \quad (2)$$

с соответствующими начальным

$$\theta(x,y,z,0)=\theta_0(x,y,z);$$
$$u=u(0);\ v=v(0); \quad (3)$$
$$w_g=w_g(0)\ \text{ при t}=0$$

и краевыми условиями

$$\left.\begin{aligned} -\mu\frac{\partial\theta}{\partial x}\Big|_{x=0}&=\eta(\theta_a-\theta);\\ \mu\frac{\partial\theta}{\partial x}\Big|_{x=L_x}&=\eta(\theta_a-\theta);\\ -\mu\frac{\partial\theta}{\partial y}\Big|_{y=0}&=\eta(\theta_a-\theta);\\ \mu\frac{\partial\theta}{\partial y}\Big|_{y=L_y}&=\eta(\theta_a-\theta);\\ -\kappa(z)\frac{\partial\theta}{\partial z}\Big|_{z=0}&=(\beta\theta-Q_0);\\ \kappa(z)\frac{\partial\theta}{\partial z}\Big|_{z=H}&=\eta(\theta_a-\theta). \end{aligned}\right\} \quad (4)$$

Здесь θ (x, y, z, t) – концентрация примеси; u, v – составляющие скоростей движения частиц по горизонтали в пограничном слое атмосферы, u_b, v_b, w_b – скорости ветра в горизонтальном и вертикальном направлениях; $\kappa(z)$ – коэффициент турбулентности, w_g – скорость осаждения частиц, μ – коэффициент диффузии по горизонтали, σ – коэффициент поглощения, β – коэффициент взаимодействия с подстилающей поверхностью, Q_0 – надземный источник выброса вредных веществ в атмосферу; η – эмпирический параметр, Q – мощность точечного источника; $\delta_{i,j}$ – функция Дирака, m – масса частицы; r – радиус частицы; t – время; g

– ускорения свободного падения; c_f – коэффициент лобового сопротивления частиц; k_f – коэффициент формы тела для силы сопротивления; F_n – подъемная сила воздушного потока; ρ_n – плотность частиц; $\rho_в$ – плотность воздуха; $\mu_в$ – вязкость воздуха.

Метод решения

Систему (16)-(23) интегрировать Задачу (1)-(4) рассмотрим в области $D=(0<x<a,\ 0<y<b,\ 0<z<H)$, а источник предполагаем расположенным в приземном слое.

Величина $Q0$ является функцией от x, y, z, t и она вычисляется в ходе решения задачи, связанной с эрозией почвы, которая зависит от метеорологических условий и свойств подстилающей поверхности, размера и плотности пылевых частиц [13-14].

Для интегрирования поставленной задачи основные параметры математической модели процесса u_b, v_b, w_b, k, μ будем определять в виде степенных функций [15]

$$u_b(z,t)=|v_1|\left(\frac{z}{z_1}\right)^n\cos\alpha,$$

$$v_b(z,t)=|v_1|\left(\frac{z}{z_1}\right)^n,$$

$$w_b(z,t)=|v_1|\left(\frac{z}{z_1}\right)^n\sin\alpha,$$

$$k(z,t)=k_0(z,t)+\bar{k}(z,t),$$

$$\mu=|\vec{v}|\left(k_x+R\theta_0^2\right),$$

где $|v_1|$ – модуль скорости ветра при $z=1$ м, α – параметр, указывающий направление ветра относительно горизонта.

Составлявшей ветра вычисляются с помощью формулы

$$\mathrm{U}=(\mathrm{u}_b^2+v_b^2+w_b^2)^{1/2}.$$

Надо отметить, что в работах многих авторов коэффициент взаимодействия с подстилающей поверхностью β изменяется в пределах $0\le\beta\le1$. Если частица попадает в твердую стенку, то считается $\beta=0$, если ударяется о водную поверхность, то $\beta=1$. Обычно часть аэрозольных выбросов в зависимости от своей массы, метеорологических и климатических условий, характеристик подстилающей поверхности и географического расположения области распространения попадает на подстилающую поверхность. Затем часть из них снова попадает в атмосферу. Считают, что β является постоянной величиной в рассматриваемой области. Это искажает прогноз распределения частиц на подстилающей поверхности. Чтобы избежать такой проблемы, при разработке математической модели процесса нужно учитывать $\beta=\beta(x,y,z)$.

Для учета поглощения аэрозольных частиц в растительном покрове коэффициент взаимодействия с подстилающей поверхностью β необходимо вычислять с помощью формулы [14, 16]:

$$\beta(x,y,z,r)=\begin{cases}0, & z>z_k,\\ 0{,}264w(z)^{1{,}65}\,w_g^{0{,}66}s(z), & z<z_h.\end{cases}$$

Здесь z_h – высота слоя растительности, $s(z)$ – удельная поверхность растительности.

Подъемная сила ветра определяется с помощью:

$$F_n=k_n\pi r^2\rho_в\mathrm{U}^2,$$

а сила лобового сопротивления

$$F_л=0{,}0078\pi r^2\rho_в\mathrm{U}^2\ ,$$

где k_n – коэффициент подъемной силы воздуха который изменяется в пределах от 0,03 до 0,18 (для почвы и песка 0,09-0,18).

Мощность надземного источника вычисляется со помощью:

$$Q_0=\frac{0.12\theta_n g}{\rho_n P}Q_0',$$

а расход примесей

$$Q_0'=\frac{c\rho_в u_*^2}{g}\left[1-\left(\frac{\mathrm{u}_{*\mathrm{kp}}}{\mathrm{u}_*}\right)^2\right],$$

где

$$c=0.25+\frac{w_g}{u_*}.$$

Критическая скорость трения вычисляется по формуле

$$\mathrm{u}_{*\mathrm{kp}}=\sqrt{0{,}0123\left(\frac{\rho_в}{\rho_n}dg+\frac{3\cdot10^4c^2}{\rho_n d}\right)}.$$

При больших скоростях ветра существует простая зависимость скорости трения u_* от средней скорости ветра u_2: $(\mathrm{u}_*-\mathrm{u}_{*\mathrm{kp}})=0.44(\mathrm{u}_2-\mathrm{u}_{2\mathrm{kp}})$.

Здесь $\mathrm{u}_{*\mathrm{kp}}=45см/с;\ \mathrm{u}_{2\mathrm{kp}}=7см/с$. При пылевых бурях u_* меняется от 50 до 80 см/с.

Выводы

Для мониторинга и прогнозирования экологических состояния промышленных регионов в отличие от рассмотренных выше работ была разработана математическая модель процесса переноса и диффузии вредных

мелкодисперсных частиц, в которой учитываются существенные параметры объекта исследования: скорость перемещения частиц аэрозольных выбросов в атмосфере, которая зависит от массы и радиуса частиц; ускорение свободного падения частиц; коэффициент лобового сопротивления частиц при переносе их воздушной массой атмосферы; коэффициент формы тела для вычисления силы сопротивления; подъемная сила воздушного потока; ρ_n – плотность частиц и воздуха; $\mu_в$ – вязкость воздуха.

Предложенную математическую модель можно использовать для достоверного прогноза состояния воздушного бассейна промышленных регионов, вследствие выброса вредных веществ из объектов производства и в следствия эрозии постилающей поверхности земли, а также для оптимального разрешения новых производственных объектов.

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SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 20.09.2018 **http://T-Science.org**

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IMPROVEMENT OF THE HOUSING CONSTRUCTION MANAGEMENT SYSTEM IN UZBEKISTAN

***Abstract**: In this article, the authors studied and analyzed the growth trend of the housing stock in the country, the reforms carried out and the results achieved in this sphere. And also, developed recommendations to optimize the housing construction on the basis of modern requirements.*

***Key words**: housing fund, housing stock management, housing construction management, feature of housing construction.*

***Language**: English*

Citation: Nurimbetov RI, Davletov IK, Khasanov TA (2018) IMPROVEMENT OF THE HOUSING CONSTRUCTION MANAGEMENT SYSTEM IN UZBEKISTAN. ISJ Theoretical & Applied Science, 09 (65): 70-74.

Soi: http://s-o-i.org/1.1/TAS-09-65-12 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.12

INTRODUCTION

Housing affordability is one of the most pressing socio-economic problems of all Commonwealth of Independent States (CIS) countries, as well as in Uzbekistan. In particular, today, in different countries of the world many local and international programs are being developed to provide the population with comfortable and affordable housing.

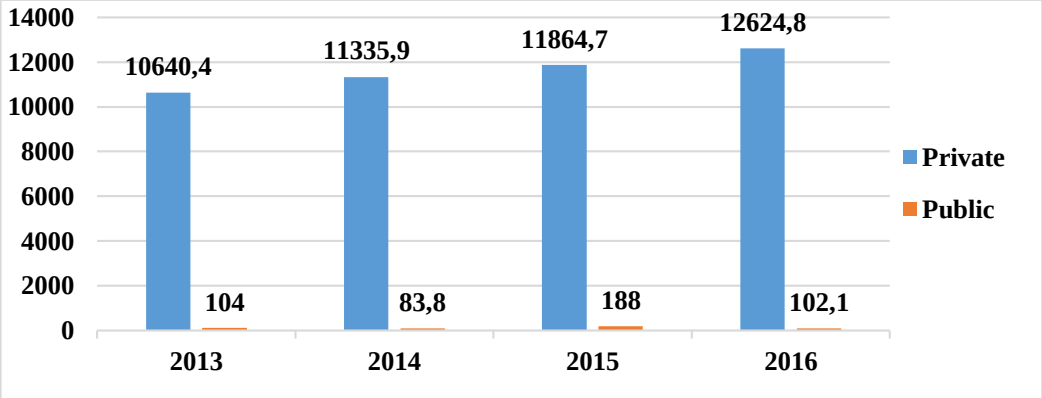
The solution of the problem depends on the increase in the volume of housing construction in Uzbekistan, the development of all the components of urban and rural infrastructure, as well as the improvement of the housing construction management system using the experience of the leading countries [8].

URGENCY

Despite the high population growth rates in Uzbekistan (over the years of independence there has been an increase of more than 9/4 million), there is a steady increase in the housing stock in the country. If in 1991 one person had 12/4 square meters of the total area, then in 2016 this figure was up to 15.4 square meters with is grew up to 1.2 times.

In addition, the newly built houses in 2013 amounted to 10744.4 square meters. In 2014, 11419.4 square meters, in 2015 to 12052.7 square meters and in 2016 - 12726.9 square meters [9].

Diagram 1. Newly renovated houses in Uzbekistan by 2013-2016 (square meters)

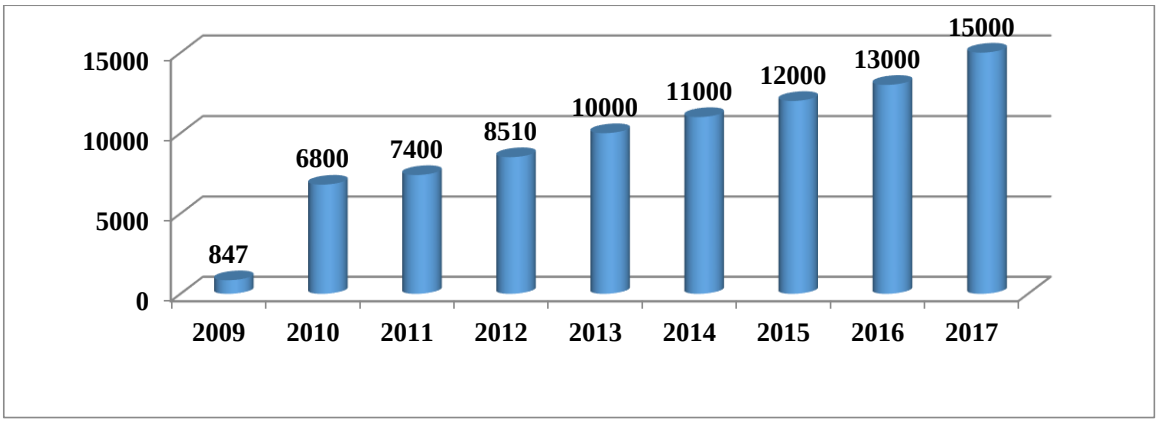


Source: ***Data of the State Committee of the Republic of Uzbekistan on Statistics [10].***

By the First President of the Republic of Uzbekistan, 2009 The Resolution of 1167 "On Additional Measures to Expand the Housing Construction in Rural Areas" of August 3, sets out the scope of construction of individual housing projects on standard projects approved in accordance with general plans of rural settlements and architectural planning projects expanded conditions for the radical improvement of the living conditions of the rural population [1].

In particular, in the period from 2009 to 2016, in 1 308 rural settlements, the total area was 9 573 thousand square meters with 69 557 comfortable houses were built and improved the living conditions of more than 83 500 rural families. Also according to such projects in 2017 15 000 houses and apartments were built.

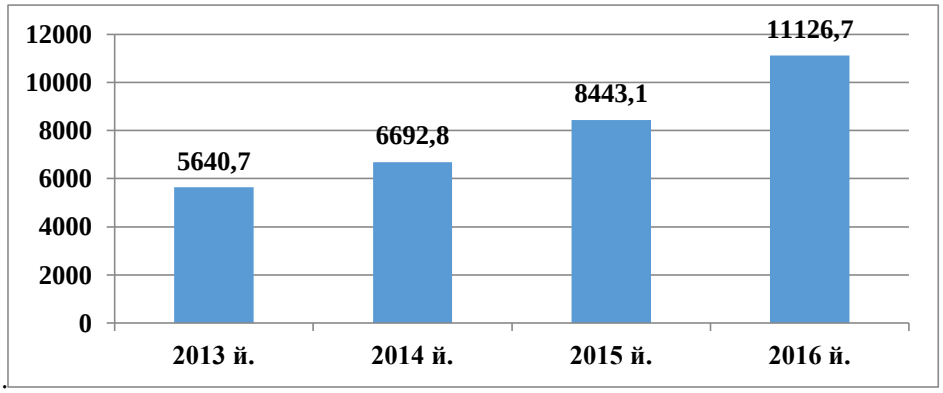
Diagram 2. Exemplary projects in rural areas number of houses constructed for 2009-2017



Source: ***Data of the State Committee of the Republic of Uzbekistan on Statistics [10].***

Considering the analysis of investment in housing, this indicator is expected to reach USD 5640.7 billion in 2013. In 2014, 6692.8 billion soums were issued. In 2015, 8443.1 billion soums will be invested. and in 2016 - 11,126.7 billion soums.

Diagram 3. The volume of investments into housing in 2013-2016 (billion soums)



Source: ***Data of the State Committee of the Republic of Uzbekistan on Statistics [10].***

Another positive result of the population's housing policy is to increase the level of development of the service sector in the country, to provide the population with new modern and quality services, to ensure economic growth and the role of the service sector in solving the problems of the population, the work being done to strengthen of the country.

Particularly, targeted state programs are being implemented to provide the rural population with drinking water and natural gas, as well as construction of trunk water and natural gas pipelines to increase the access of the population to safe drinking water and natural gas.

THEORETICAL APPROCHES

According to the President of the Republic of Uzbekistan Sh.Mirziyoev in 2016 Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On the Program of Construction of High-Rise Residential Houses on Updated Model for Rural Areas for 2017-2021" on October 21, in Uzbekistan, comfortable housing is being built on new model projects, taking into account the characteristics of national mentality and rural living conditions as well as high level of preferential lending and wide use of new types of energy-saving materials and equipment. These, in turn contribute to the reduction of the cost of new construction and the establishment of optimal prices for all layers of the population [2].

The national model of housing construction in Uzbekistan is distinguished by the following characteristics:

- development of rural housing construction is seen as a long-term strategic priority;
- designing a house for the population to have their own home-based mentality and regional traditions;
- high share of private housing construction in shared housing;
- the demographic factor has a significant impact on the housing demand (young families and population growth, household structure and structure);
- a comprehensive (scale) system of privileges and benefits for sustainable development of housing construction.

Today in our country a great deal of attention is paid to finding solutions to housing problems, identifying housing construction prospects, efficient use of housing and reconstruction. However, today's practice shows that housing construction does not take into account the optimization of the structure of the housing fund and the substantiation of market factors. This leads to imbalance in the housing of different categories of households, the deficit of some types of housing, and the excessive construction of other quartzs and, in general, the misuse of the country's housing stock [7].

This problem can be solved the optimal structure of housing construction can be modeled on this process. Modeling is related not only to the predictability of external factors, but also to the structure and scope of development of housing construction, but to the choice and justification of economic policy in the field of scientific and technological progress, investments, prices and other factors.

It is important to consider the length of the investment period in the construction of modern housing. The complexity, complexity and multi-dimension of the problem require a complex, systematic approach to the solution. The combination of information-logical modeling and economics-mathematical approaches makes it possible to develop the optimal model.

ANALYTICAL PART

The most commonly used and proven method used by experts today is simple and combinational groups based on information-logical modeling. There

are some drawbacks along with the positive aspects of using these methods. Because they do not allow the effect of each factor. Therefore, in this study, we have been using additional economic and mathematical methods, which enables us to incorporate quality-theoretical analysis into quantitative terms. Thus, in all sectors of the regional construction complex, including housing, there is an opportunity for accurate mirror investigation [3;4].

Theoretical model of housing construction improvement can be as follows:

$$S = f(T, O, П, Э, Э_1, Д, К, С, Г) \quad (1)$$

Here:

S – housing fund structure;

T – technical (construction of living space with technical means and on what technological basis);

O – organizational (interrelationships in the entire production chain - from banks to wholesale to construction materials, labor supply and so on);

$П$ – legal (implementation of all legislative acts in the area of housing);

$Э$ – economic (implementation of the basic rules of the market economy);

$Э_1$ – ecological (observance of rules of sun and air insulation, safe placement, etc.);

$Д$ – demographic (all factors - gender and age to national characteristics);

$К$ – cultural (compliance with all national traditions and traditions in architecture and design, inculcation of advanced international experience);

$С$ – social (accounting for material possibilities, government support and assistance);

$Г$ – town-planning (observance of town-planning rules and procedures).

At the same time, it is necessary to address the most important issue in the field of housing - to ensure investment and the rational use of all material and technical resources.

The most important issue in the development of effective decisions on housing construction is the validity of optimality criteria, i.e:

- identification of key issues in housing construction;
- selection of the most important quantitative indicators;
- identification of the most important issues for a specific type of construction (brick or panel option), specific area (characteristics of the regional development), and the number of concrete housing (minimum 1-2, maximum 7), etc. .;
- simplicity of accountability for clarity for all professionals at all levels and regions;
- reflect the process in dynamics.

Approaches to the construction of housing construction should take into account organizational and economic changes with the formation of market relations [5;6]:

1) housing construction does not reach the target indicators but works on the terms of contractual relations with all participants of the investment project;

2) the price of the product, including the latest, ie, the cost of ready-made housing, is formed under the influence of market mechanisms;

3) Thus, the balance of demand and supply of housing is an essential element.

According to them:

1) the share of the state is sharply reduced;

2) the size of the non-state sector has increased and primarily due to the construction of individual homes by individual persons;

3) loss of management of a construction complex, for example in Tashkent, with the completion of the construction project;

4) regulation is carried out economically, although some aspects of administrative intervention are involved;

5) limitation of administrative interference.

Taking into account the abovementioned, housing construction can be structured in the following areas:

I. Development of a housing construction model with demarcation of time and duration of the construction;

II. The development of the multi-level model - the opportunity to use this model in the city, district, at the enterprise level;

III. Establishing all the uncertainties and risks, primarily the investment block, the capacities of construction and installation companies and the production and technical base, and setting prices for different types of housing.

IV. Optimization of the housing fund structure, with different parameters, describes the district (territory) where the house is located from the number of rooms in the apartment.

Also, in order to identify potential households, it is important to take into account the level of hospitality that should be taken into consideration, not to mention how many years a person should work for the purchase of housing, but also the support of the state and the various structures.

The principle of housing construction, as well as a vector indicator, takes into account the following:

1) the structure of social housing construction;

2) the structure of commercial housing construction.

These two directions are independent. In the first case, the issue of allocating a flat free and privileged land is solved, and the second one is that individual individual builders will spend their own resources. However, in both cases, the government can provide "assistance". In the first case, public funds are used and various loans are attracted. In the

latter case, builders can use different types of credit privileges, in absolute terms.

Vector vector - the required structure of social housing construction will serve to meet the housing needs of the population:

V_i^t – t period i- the size of the housing stock;

Π_i^t - t period i- demand for housing.

$$V_i^t - \Pi_i^t \rightarrow min, \text{ или } 0 \quad (2)$$

In this case, the Housing Demand Level indicator can be calculated using the following formula:

$$S = \frac{V_i^t}{\Pi_i^t} \quad (3)$$

In this case, you can calculate depending on the number of flats required, as well as calculate by the number of 1,2,3,4 rooms and houses.

CONCLUSION

The procedure for calculating the aggregated structure of the social housing offered by us is essential for the implementation of socially-oriented and financially balanced housing policy in Uzbekistan.

The aggregated vector of commercial housing construction is based on different schemes of financing housing construction. This is to say that the selection of the right financing scheme usually determines the amount of funds ready by the subject for housing. Thus, the structure of commercial housing construction depends on the amount of capital spent.

So, we can see from the model model that investor (home buyer) $\hat{Z}$ seeks to get the most out of the total area, where the amount of funding for the I-type home fund; At the same time, the average cost per 1 sq m of housing for i-type housing.

$$S = \frac{O_i^t}{Ц_i^t} \quad (4)$$

At the same time, the model of optimization of the structure of commercial buildings will be shown in the following format:

- Number of flats of type I in the form of i-housing stock in t-year;
- The average price per 1 sq m of the i-series in the t-year;
- Type i-type of housing with type j of the year t

$$K_{ji}^t \cdot Ц_i^t \cdot O_i^t \rightarrow min \quad (5)$$

Taking all accounts it is possible to conclude that this article is based on the creation of economic mathematical models and the use of special mathematical methods to build a common model of optimal construction of housing in Uzbekistan and minimize all computing operations using modern computer software.

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Impact Factor:	ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS
International Scientific Journal
Theoretical & Applied Science
p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)
Year: 2018 **Issue:** 09 **Volume:** 65
Published: 21.09.2018 **http://T-Science.org**

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SECTION 11. Biology. Ecology. Veterinary.
UDC 612.117 + 612.017.1 + 612.014.4

AGE DYNAMICS OF ELECTRICAL CARDIAC AXIS IN HEALTHY PEOPLE IN CONNECTION WITH CHANGE SOMATOMETRIC STATUS DRUG PERIODS OF POSTNATAL ONTOGENESIS

Abstract: *The relationship between the somatometric status and the age dynamics of the electrical axis of the heart is shown. To study this dependence, an experimental material was collected, which allowed the development of a somatotype determination model taking into account age dynamics of the angle of inclination of the electric axis of the heart. As a result of the study, the limits of the alpha angle variation of the electrical axis of the heart for different ages and somatotype were determined. The age-related limits of the values of the angle of inclination of the electric axis of the heart, obtained with the help of the model, can be used for comparison as the proper values with the data of the electrocardiography analysis.*

Key words: *electrical cardiac axis, somatotype, the somatometric status physique, Pignier index*
Language: *Russian*
Citation: Drozdov DN, Shahlenkova LS (2018) AGE DYNAMICS OF ELECTRICAL CARDIAC AXIS IN HEALTHY PEOPLE IN CONNECTION WITH CHANGE SOMATOMETRIC STATUS DRUG PERIODS OF POSTNATAL ONTOGENESIS. ISJ Theoretical & Applied Science, 09 (65): 75-81.
Soi: http://s-o-i.org/1.1/TAS-09-65-13 ***Doi***: https://dx.doi.org/10.15863/TAS.2018.09.65.13

ВОЗРАСТНАЯ ДИНАМИКА ЭЛЕКТРИЧЕСКОЙ ОСИ СЕРДЦА У ЗДОРОВЫХ ЛЮДЕЙ В СВЯЗИ С ИЗМЕНЕНИЕМ ИХ СОМАТОМЕТРИЧЕСКОГО СТАТУСА В РАЗНЫЕ ПЕРИОДЫ ПОСТНАТАЛЬНОГО ОНТОГЕНЕЗА

Аннотация: *В работе показана связь соматометрического статуса с возрастной динамикой электрической оси сердца. Для исследования этой зависимости собран экспериментальный материал, который позволил разработать модель определения соматотипа с учетом возрастной динамики угла наклона электрической оси сердца. В результате исследования определены границы варьирования угла альфа электрической оси сердца для разного возраста и соматотипа. Полученные с помощью модели возрастные границы значений угла наклона электрической оси сердца, могут быть использованы для сопоставления в качестве должных величин с данными ЭКГ-анализа.*

Ключевые слова: *электрическая ось сердца, соматотип, телосложение, индекс Пинье*

Введение.

Возрастные изменения в работе сердца выражаются в динамике показателей электрокардиограммы. Среди этих показателей особый интерес представляет возрастная динамика электрической оси сердца (ЭОС). В ряде случаев крайнее правое и крайнее левое положение ЭОС служит дополнительным диагностическим признаком нарушения проводимости и состояния гипертрофии миокарда предсердий, желудочков, а также блокады ножек пучка Гиса. В настоящее время в доступной научной литературе представлены данные о вариации положения ЭОС, связаны с той или иной формой патологии сердца. Например, гипертрофией миокарда спортсменов [1, 2], алкогольной интоксикацией сердца [3], гипертрофической кардиомиопатией (ГКМП) обусловленной генетическими нарушениями [4] и др. Однако вариация положения ЭОС зависит не только от патологических, но и от морфологических изменений, как в самом сердце, так и в целом в организме человека. Среди возрастных изменений, происходящих на уровне организма, можно выделить колебания мышечной и жировой массы тела, а также изменения,

возникающие в результате перераспределения гемодинамической нагрузки из-за этих колебаний.

У здорового человека угол наклона ЭОС на фронтальную плоскость или на ось первого стандартного отведения (угол альфа), располагается в сегменте от 0 ° до + 90 ° (нормограмма) и изредка выходит за эти пределы [5]. В норме угол наклона ЭОС соответствует углу наклона и ориентации анатомической оси сердца. Отклонение в направление горизонтального положения, когда угол альфа с фронтальной плоскостью составляет от 0 ° до 29 ° (левограмма) встречается у здоровых людей с гиперстеническим типом телосложения (дигестивный тип), отклонение в направление вертикального положения попадает в сегмент от 90 ° до 75 ° (правограмма) и характерно для здоровых людей с астеническим типом телосложения. В возрастном аспекте в норме у детей грудного и дошкольного возраста (до 7 лет) имеет место отклонение ЭОС вправо. У детей школьного возраста и подростков, вплоть до окончания пубертатного периода (от 7 до 15-17 лет) устанавливается нормальное положение ЭОС, которое сохраняется до 60 лет, у людей старше 60 лет доминирует левограмма. В литературных источниках указывается, что в течение жизни в динамике положения ЭОС наблюдается тенденция отклонения этого показателя из вертикального в горизонтальное положение, которую обуславливают возрастные изменения пропорций тела [6].

Изучение возрастной изменчивости пропорций тела человека и влияния соматотипических особенностей на физическое развитие и физиологический статус, имеет достаточно большую историю и подробно рассмотрены в работах отечественных и зарубежных ученых (Л.Ф. Яроцинский, К.О. Фалькович, В.В. Бунак, П. Н. Башкиров, У. Шелдон, Л. Картер и др.). В работах Русалова (1979) получены убедительные экспериментальные доказательства того, что соматотип действует как единый фактор. В ряде работ, М.С. Маслова, М.В. Черноруцкого, В.Н. Шевкуненко, установлена связи между весоростовыми показателями и сенситивностью разных систем организма человека. Анализ динамики этих признаков в онтогенезе показал, что в период полового созревания у подростков дигестивного и астенического типа наблюдается более раннее прекращение роста тела в длину, что обусловлено отличным от нормостенического типа, уровнем секреции половых гормонов. В работах М. В. Черноруцкого показано, что среди гиперстеников частота людей с повышенным неустойчивым содержанием сахара выше, чем у нормо- и астеников. Последующие изменения скорости метаболизма и колебания гормонального статуса у людей с разным типом конституции в зрелом и пожилом возрасте могут быть сопряжены с выраженными колебаниями массы тела, увеличением нагрузки на диафрагму, изменение объема и протяженности кровеносного русла и других изменений. В результате происходят изменения геометрии и ориентации сердца в грудной полости. В этой связи определенный научный интерес представляет изучение динамики ЭОС у здоровых людей в связи с изменением их соматометрического статуса на протяжении разных периодов жизни.

Целью исследования являлось определение возрастных особенностей в динамике ЭОС у людей с разным соматометрическим статусом в пяти возрастных группах: дети дошкольного возраста от 4 до 7 лет, дети школьного возраста от 7 до 17 лет, взрослые от 21 до 35 лет (I период зрелого возраста), от 36 до 60 лет (II период зрелого возраста) и взрослые старше 60 лет.

Материалы и методы.

Для определения возрастной динамики ЭОС и оценки зависимости этого показателя от типа телосложения использовались результаты обследования лиц разного пола и возраста, проводимые за период 2015-2018 гг. на базе ГУЗ «Октябрьская больница» и лаборатории кафедры зоологии, физиологии и генетики УО «ГГУ имени Ф. Скорины». В обследовании приняли участие 375 человек, из них данные 264 человека использовались для проведения классификации и разработки кластерной модели соматотипов. Из общей выборки отбирались люди с выраженными особенностями телосложения, и значением индекса крепости телосложения, позволяющим определить принадлежности к тому или иному соматотипу (не менее 3-х человек в каждой возрастной группе). Измерение показателей ЭКГ проводились на оборудовании типа Интекард-3 и Альтоник-6 в соответствие с МУ; Рег. удостоверение № ИМ-7.6566/1604 ТУ BY100050381.001-2005. При проведении обследования проводилась запись протокола, куда вносили данные о возрасте, результатах измерения длины, массы тела, окружности грудной клетки на вдохе и результатах ЭКГ анализа. Определение типа соматической конституции проводилось по методу Черноруцкого (Черноруцкий М.В., 1949 Чтецов В.П., 1972), который может быть использован в качестве количественной характеристики соматотипа для разных возрастных групп [7, 8]. В основе метода лежит визуальная оценка и расчет индекса Пинье (показателя крепости телосложения). Согласно значениям индекса участники были распределены в три группы: астеники (больше 30), нормостеники (10 – 30) и гиперстеники (меньше 10).

Массив данных разделен на группы в соответствие с выбранной нами градацией: дети дошкольного возраста от 4 до 7 лет, дети школьного возраста от 7 до 17 лет, взрослые от 21 до 35 лет (I период зрелого возраста), от 36 до 60 лет (II период зрелого возраста) и взрослые старше 60 лет. Выбранные периоды жизни захватывают время, в течение которого происходят наиболее выраженные изменения компонентов тела. У детей относительное развитие костного и мышечного компонента уступает жировому компоненту. У европеоидных мальчиков минимальные значения жироотложения наблюдаются в возрасте 8 лет, и достигает максимума к 12-13 годам (около 9 кг), после чего происходит падение жироотложения. У девочек наименьшие показатели роста жироотложения приходятся на 7 лет, но сам процесс продолжаются вплоть до 17 лет. К 21-ти годам устанавливается определенный ростовой баланс, где мышечная масса достигает наибольшего развития. В последующий период ближе к 30-ти годам происходит относительное уменьшение мышечного компонента и увеличение жирового. Особенно яркие изменения проявляются после 60 лет, когда начинает снижаться и жировой компонент тела (Морфология человека, 1990) [8].

Достоверности различий оценивалась исходя из нормального распределения значений соматометрических показателей и данных ЭКГ анализа на основе t-критерия Стьюдента. Для проведения анализа использовались методы регрессионного, кластерного и дискриминатного анализа. Кластерная модель разработана по аналогии модели [9]. Статистическая обработка результатов исследования выполнена с помощью прикладных программ *MS Office Excel 2007* и *Statistica for Windows 6.0* [10].

Результаты исследования и обсуждение.

В результате обследования получены данные позволившие рассчитатьсредние значения основных показателей соматометрии (длина, масса тела и окружность грудной клетки) у лиц мужского и женского пола в разные возрастные периоды. В таблице 1 приведены усредненные данные показателей соматометрии для лиц мужского пола.

Таблица 1

Возрастные показатели соматометрии лиц мужского пола

Возрастная группа	Длина тела, см	Масса тела, кг	ОГК, см
от 4 до 7 лет	119,5±4,4	25,2±2,4	58,8±2,2
от 7 до 17 лет	155,9±1,9	48,1±1,5	74,7±0,9
от 21 до 35 лет	175,8±1,3	72,4±2,1	95,1±0,8
от 36 до 60 лет	176,8±0,9	83,3±2,4	92,5±1,4
старше 60 лет	170,6±0,7	75,9±4,9	88,9±9,2

Из таблицы 1 видно, что наибольшая вариация длинны тела, наблюдается у детей и подростков в возрасте 7 – 17 лет 12 %, массы тела – 27 %, у взрослых мужчин внутригрупповые вариации этих показателей не превышает 10 %.Минимальные вариация длинны тела наблюдается у мужчина старше 21 года и снижается к пожилому возрасту. Наибольшие значения вариации окружности грудной клетки наблюдаются в возрасте 7 – 17 лет и старше 60 лет – более 12 %, минимальная вариация этого показателя наблюдается в первого периода зрелости – 4 %. Сравнительный анализ показателей соматометрии показал достоверные различия между тремя возрастными группами – 4 – 7 лет, 7 – 17 лет и группой старше 21 ($p < 0,05$). Группы первого, второго периода зрелости и пожилого возраста не показали достоверного различия по данным показателям ($p > 0,05$).На основании данныхсоматометрии для каждой возрастной группы были рассчитаны значения индекса крепости телосложения (индекс Пинье) и индекс массы тела (индекс Кетле). На рисунке 1 представлена возрастная динамика средних значений индекса крепости телосложения и массы тела.

Из рисунка 1 видно, что прослеживается четкая тенденция снижения с возрастом индекса Пинье и увеличение индекса Кетле. Полученная закономерность указывает на перераспределение количества мужчин из общей выборке в направление от большего количества с астеническим типом телосложения в период детства, в сторону нормостении (в зрелом возрасте), а затем гиперстении во IIпериоде зрелого и пожилом возрасте. Коэффициент наклона линейной регрессия для индекса крепости телосложения составил – 7,2, коэффициент детерминации 0,82 ($p < 0,05$). Коэффициент наклона линейной регрессия для индекса крепости

телосложения составил + 2,1, коэффициент детерминации 0,92 ($p < 0,05$).

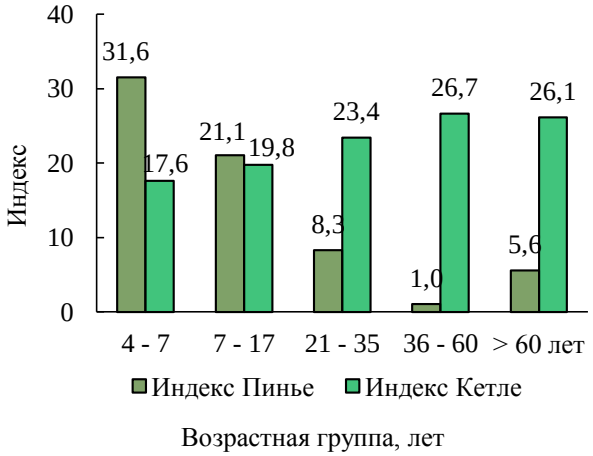

Рисунок 1 – Динамика индексов крепости телосложения и массы тела мужчин

В каждой возрастной группе были получены распределение индекса крепости телосложения, и в соответствие с методом Чернорудкого определены и отобраны по три человека с характерными признаками каждого соматотипа. В таблице 2 приведены средние значения показателей соматометрии астеников, нормо- и гиперстеников. В результате анализа данных в возрастной группе 36 – 60 и старше 60 лет мужчин астенического типа телосложения не оказалось.

Таблица 2

Соматометрия мужчин с разным типом телосложения

Возрастная группа	Длина тела, см	Масса тела, кг	ОГК, см
Астенический тип			
4 - 7 лет	116,2±5,2	18,5±2,4	55,4±1,7
7 - 17 лет	149,8±5,2	38,4±3,7	67,4±2,5
21 - 35 лет	173,2±0,9	62,6±2,6	80,0±2,8
36 - 60 лет	-	-	-
> 60 лет	-	-	-
Нормостенический тип			
4 - 7 лет	100,5±6,6	18,8±1,7	54,5±3,8
7 - 17 лет	155,6±6,8	55,5±3,8	79,5±2,6
21 - 35 лет	177,9±1,3	69,4±0,6	91,9±2,8
36 - 60 лет	176,9±2,4	71,3±3,5	92,0±2,5
> 60 лет	172,0±0,8	68,0±6,4	82,0±4,6
Гиперстенический тип			
4 - 7 лет	-	-	-
7 - 17 лет	148,9±13,9	58,6±5,8	85,2±7,8
21 - 35 лет	174,5±3,9	77,6±5,9	96,3±3,5
36 - 60 лет	176,8±1,9	85,3±3,9	100,5±4,1
> 60 лет	170,0±1,5	82,2±4,4	102,2±0,5

В таблице 4 приведены усредненные данные показателей соматометрии лиц женского пола. Сравнение коэффициентов вариации между возрастными группами показало, что, как и в случает мужчин, наибольшая вариации показателей соматометрии наблюдается в возрасте

7 – 17 лет, где значения этого показателя для длины тела составило – 11 %, для массы тела – 26 %,для окружности грудной клетки – 13 %. Сравнительный анализ показателей соматометрии женщин показал достоверные различия длины тела между всеми возрастными группами ($p < 0,05$), кроме группы 21 – 35 и 36 – 60 лет ($p > 0,05$).

Таблица 3

Возрастные показатели соматометрии лиц женского пола

Возрастная группа	Длина тела, см	Масса тела, кг	ОГК, см
от 4 до 7 лет	116,0±3,8	25,9±3,2	56,0±2,5
от 7 до 17 лет	148,5±3,2	45,3±2,5	72,2±1,9
от 21 до 35 лет	166,3±1,0	57,9±2,8	84,4±0,7
от 36 до 60 лет	164,0±1,5	65,8±1,6	91,3±1,8
старше 60 лет	157,6±0,2	68,6±1,8	102,4±1,2

На рисунке 2 представлена возрастная динамика средних значений индекса крепости телосложения и массы тела у женщин. Из рисунка видно, что в группе женщин тенденция снижения индекса крепости телосложения и увеличения массы тела не отличается от показанной выше динамики у мужчин. Вследствие чего можно сделать вывод об отсутствие каких-либо достоверных различий в возрастной динамике основных показателей соматометрии и наличие полового диморфизма.

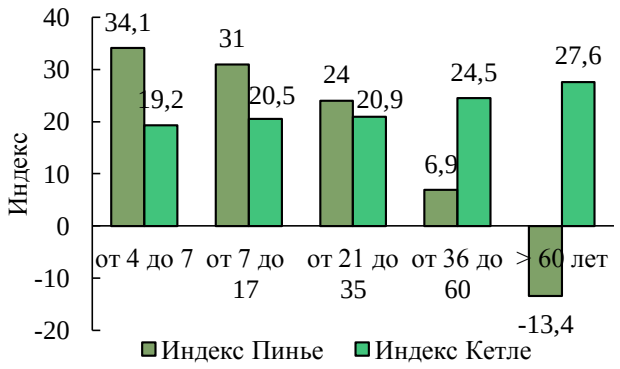

Рисунок 2 – Динамика индексов крепости телосложения и массы тела женщин

Коэффициент наклона линейной регрессия для индекса крепости телосложения составил – 12, коэффициент детерминации 0,91 ($p < 0,05$). Коэффициент наклона линейной регрессия для индекса крепости телосложения составил + 2, коэффициент детерминации 0,91 ($p < 0,05$). В данном случае обращает внимание больший угол наклона динамики индекса крепости телосложения у женщин в сторону гиперстенического типа. В таблице 5 приведены средние значения показателей соматометрии женщин астеников, нормо- и гиперстеников.

Таблица 4

Соматометрия женщин с разным типом телосложения

Возрастная группа	Длина тела, см	Масса тела, кг	ОГК, см
Астенический тип			
4 - 7 лет	121,7±5,3	25,7±2,6	57,6±2,2
7 - 17 лет	142,8±4,3	36,8±2,7	69,2±2,2
21 - 35 лет	169,9±2,8	58,8±2,2	82,6±0,5

36 - 60 лет	-	-	-
> 60 лет	-	-	-
Нормостенический тип			
4 - 7 лет	112,4±6,1	28,8±3,4	58,9±3,7
7 - 17 лет	156,8±3,6	51,6±3,1	81,7±1,6
21 - 35 лет	165,6±1,6	60,2±0,6	84,7±0,9
36 - 60 лет	165,6±1,7	63,1±2,2	88,8±1,9
> 60 лет	-	-	-
Гиперстенический тип			
4 - 7 лет	114,7±10,9	36,2±3,5	64,9±7,1
7 - 17 лет	129,8±6, 9	45,2±5,7	73,8±2,8
21 - 35 лет	166,4±1,7	65,3±1,8	94,7±1,3
36 - 60 лет	162,2±1,2	68,2±3,6	93,2±2,2
> 60 лет	158,0±0,8	69,0±3,9	102,0±4,2

Статистический анализа данных, представленных в таблицах 2 и 4, а также расчетные значения показателей крепости телосложения и индекса массы тела в каждой группе подтвердил общую тенденцию, полученную на общей выборке – с возрастом в популяции мужчин и женщин происходит снижение индекса Пинье и увеличение индекса Кетле. Динамика этих процессов хорошо описывается уравнением линейной регрессией, где коэффициент смешанной корреляции превышает 0,9.

Используя методику кластерного анализа, установлено, что в общей выборке выделяются группы людей (3 кластера), значения показателей соматометрии которых имеют достоверное отличие ($p < 0,05$). В первый кластер вошли типичные астеники, во второй – нормостеники, в третий – гиперстеники. На основании статистических характеристик каждого кластера методом дискриминантного анализа разработано правило классификации, позволяющее по данные обследования и учетом возраста определить принадлежность человека к одному из кластеров. Значения коэффициента Wilks' Lambda составило 0,09163 approx. $F (8,516) = 148,58$ $p < 0,001$), что указывает на высокую точности дискриминации. Правило классификации принимает следующий вид (1-3):

$$Y1 = -0,85A + 0,95H – 1,97W + 1,81P – 88,9 \quad (1)$$

$$Y2 = -0,96A + 0,56H – 1,30W + 2,28P – 97,1 \quad (2)$$

$$Y3 = -0,85A + 0,28H – 0,79W + 2,41P – 92,9 \quad (3)$$

где A – возраст, полных лет; H – длина тела, см; W – масса тела, кг; P – окружность грудной клетки, см.

Из кластерных ядер в возрастных группах были определены границы варьирования угла альфа электрической оси сердца, которые представлены в таблице 6. К сожалению, таблица не заполнена полностью, поскольку исследование ограничено выборочными данными. Тем не менее, из данных представленных в таблице 6 видно, что значения угла электрической оси с возрастом смещается от первого кластера к третьему, как у мужчин, так и у женщин, т.е. от положения соответствующего правограмме к положению левограммы.

Из таблицы 6 видно, что положение угла наклона электрической оси сердца является характерной отличительной особенностью людей разного возраста и типа телосложения. Наиболее выражены эти отличия в детском и пожилом возрасте, где достоверная вероятность различия менее 0,05.

Таблица 5

Возрастные значения угла альфа ЭОС

	ЭОС, градус					
	Мужчины			Женщины		
Группа	1	2	3	1	2	3
4 - 7	83,1±3,5	-	-	76,1±2,2	-	-
7 - 17	57,5±4,3	49,4±3,0	37,1±2,1	52,9±3,6	49,8±1,0	38,1±2,1
21 - 35	-	45,3±1,4	29,5±1,3	-	42,2±3,0	29,5±2,3

36 - 60	-	46,3±2,4	27,8±0,8	-	-	28,0±1,9
> 60	-	-	25,5±2,3	-	-	21,5±0,6

Достоверные различия между мужчинами и женщинами показаны в группе детей 4 – 7 лет и людей старше 60 лет ($p < 0,05$). Между мужчинами и женщинами нормостенического типа достоверные различия средних значений угла ЭОС не установлены ($p > 0,05$). Полученные результаты полностью согласуется с литературными данными и позволяет сделать вывод о стойкой тенденции, которую обуславливают различия возрастных изменений у людей с разным соматотипом.

Заключение.

Полученные результаты свидетельствуют о наличие зависимости возрастного соматометрического статуса (т.е. возрастных особенностей соматотипа) и положения электрической оси сердца у людей разного пола и возраста. В результате исследования для практических целей разработана кластерная модель, которая позволяет без предварительного определения каких либо соматометрических индексов определить тип телосложения человека. Модель учитывает возрастные границы нормы не только показателей соматометрии того или иного типа, но и возрастную динамику угла наклона электрической оси сердца. Полученные с помощью кластерной модели соматотипов возрастные границы нормы значений угла наклона электрической оси сердца, могут быть использованы для сопоставления в качестве должных величин с данными ЭКГ-анализа. Однако следует отметить необходимость увеличения объема экспериментального материала, для уточнения полученных границ варьирования угла альфа и определения таковых в тех группа, где они не были определены.

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Impact Factor:			
ISRA (India) = 1.344	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 0.829	РИНЦ (Russia) = 0.156	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 4.102	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 5.667	

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2018 **Issue:** 09 **Volume:** 65

Published: 24.09.2018 **http://T-Science.org**

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SECTION 31. Economic research, finance, innovation, risk management.

THE EFFECT OF DIVERSITY OF THE NATIONALITY, BOARD OF DIRECTOR, INVESTMENT DECISION, FINANCING DECISION, AND DIVIDEND POLICY TO COMPANY VALUES

Abstract: *Purpose in research which is to analyze the influence of diversitas nationality broad of directors, investement decision financing decision , and dividends policy on the company one manufacturing companies at the indonesian stock exchange .The research is research is quantitative with a population of manufacturing companies listed on the effect indonesia of 2013-2016. The sample used purposive sampling. Multiple regression analysis was used. Data was collected from secondary data and all the information required of the Indonesia stock exchange. The research results show that the board of commissioners board of directors of foreign influential in significant impact on value of enterprise, investement decision influential in significant impact on value of enterprise, financial decision influential in significant impact on value of enterprise, dividend policy do not affect significant impact on value of enterprise and the board of commissioners, investement decision, financial decision, and dividend policy under significant on the perceived value.*

Key words: *Diversity of The Nationality, Board of Director, Investment Decision, Financing Decision, and Dividend Policy.*

Language: *English*

Citation: Ekaningtias D (2018) THE EFFECT OF DIVERSITY OF THE NATIONALITY, BOARD OF DIRECTOR, INVESTMENT DECISION, FINANCING DECISION, AND DIVIDEND POLICY TO COMPANY VALUES. ISJ Theoretical & Applied Science, 09 (65): 82-91.

Soi: http://s-o-i.org/1.1/TAS-09-65-14 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2018.09.65.14

1. INTRODUCTION

An increasingly modern business world, the development of science and technology and good economic conditions can lead to competition in the business world. To be able to increase the value of the company, the manager will be able to manage the company's finances effectively and efficiently.

In recent years the movement of Foreign Citizens in Indonesia has grown very rapidly. Based on research conducted on Norwegian companies or by [1, p. 1] it was found that the Anglo American corporate governance system could make the company improve its reputation in the global market. The corporate governance system in Indonesia is their two systems, which can be used as the so called board and the board of directors is a supervised board.

According to [1, p. 1] the board structure in Indonesian companies adheres to its two systems, which consist of the board of directors as managers and the board of commissioners as the party that supervises.

Optimization of company values can be used to make financial decisions and reduce corporate value [2, p. 819]. Company managers have the task and task to make decisions to achieve a company project [3, p. 89] to be able to meet the needs of investors, financial managers try to maximize investor credibility by making financial decisions and policies, namely investment decisions, financing decisions and dividend policy. All three decisions are very necessary to do because these results influence each other and affect the value of the company.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

a. The value of the company

[4, p. 98] defines the value of a company as an appreciation or appreciation of investors towards a company. This value is reflected in the company's stock price. Investors who judge companies have well prospects in the future will tend to buy shares of the company. The company's value is basically measured from several aspects, one of which is the company's stock market price, because the company's stock market price reflects the investor's valuation of the overall equity held. Company value can be measured by Market to Book Ratio (MBR) [3, p. 89] and [5, p. 22]:

$$MBR = \frac{\text{Market Price per Share}}{\text{Book Value per Share}}$$

b. Nationality Diversity

Council diversity is defined as the distribution of differences between members of the board of directors and directors that relate to characteristics regarding differences in attitudes and opinions [5, p. 22] and [6, p.11]. The characteristics of the board viewed from nationality or nationality other than the country where the company is located is what is meant by the diversity of foreign nationalities.

The presence of foreign directors and directors reflects a different idea regarding the role of the board of companies in relation to the role of control, especially if they come from countries with stronger shareholder rights. The advantage of the existence of foreign directors, including: (1) available broader qualified board member candidates (with broader industry experience), (2) with different backgrounds, foreign directors can add to a more diverse and valuable experience, which is not owned by the domestic board of directors, and (3) members of the foreign board of directors can help convince foreign investors that the company is managed professionally [7, p. 1].

The composition of the board of directors of foreign citizens can be seen from the results of ethnic diversification in a company. The existence of citizen board of directors, the company is able to lift the company's image because the citizens of the country are more competent and professional in their fields, which in turn will increase the value of the company [8, p. 85]. The foreign council can bring opinions and perspectives that vary in language, religion, experience, education, life culture and professionalism that differ from country to country [9, p. 231] and [10, p. 605].

The advantage of the existence of foreign directors, among them: (1) available wider qualifying board member candidates (with broader industry experience), (2) with different backgrounds, foreign directors can add more experience diverse and valuable, which is not owned by the domestic board of directors, and (3) members of the foreign board of directors can help convince foreign investors that the company is managed professionally [11, p. 373].

c. board of Commissioners

According to the National Committee on Corporate Governance policy, the board of commissioners is a corporate organ that has the collective duty and responsibility to supervise and advise the directors and ensure that the company carries out Good Corporate Governance. Based on Law No. 40 of 2007, the purpose of the existence of the board of directors is to supervise the course of business and provide advice to the board of directors.

The advantage of a company if it has a foreign national councilor is the existence of broader industry experience, as well as market image that assesses that companies with foreign board members work professionally [1, p. 1]. The experience and imaging will make investors give more sacrifices through investing in companies.

The higher the company's stock price means that the greater the willingness of investors to sacrifice for the company and the value of the company will also increase. With the duties and authorities possessed by a board of commissioners, as well as the advantages of a foreign councilor, the nationality of the board members of the company is said to have an influence on the value of the company. The more members of the board of commissioners of foreign nationality, it can be said that the value of the company will also be higher. In a company the proportion of foreign commissioners is calculated by comparing the total number of board of commissioners, following the formula to determine the proportion of foreign commissioners [1, p. 1].

As for measuring the proportion of the board of commissioners, with the following formula: Proportion

$$KI = \frac{KI}{DK} \times 100\%$$

d. Board of Directors

The board of directors is responsible for the running of the company, the achievement of company objectives, corporate financial reporting, and receiving advice given by the board of commissioners [9, p. 231]. The higher the company's stock price means the greater the willingness of investors to sacrifice for the company and the value of the company will also increase. With the duties and authority possessed by a board of directors, as well as the advantages of a foreign councilor, the nationality of the board members of the company is said to have an influence on the value of the company. The more members of the board of directors who are foreign nationals, it is said that the value of the company will also be higher.

e. CEO or CFO

The CEO (Chief Executive Officer) is the highest position in the company that has the responsibility to manage all company activities. The CEO is fully responsible for the management and running of the company. The CEO is the executive at the top of the company and is responsible for the survival and success of the company [12, p. 1002]. CFO (Chief Financial Officer) is a position in a company that has primary responsibility for managing the company's financial risk.

f. Investment Decision (Investement Decision)

Investment decisions are one of the functions of financial management concerning the management of funds both sourced from within and from outside the company, in various forms of investment decisions aimed at obtaining finance that is greater than the cost of funds in the future. Another goal of the investment decision is not just to gain profits in the future, but to maximize the value of the company [13, p. 1].

Investment decisions are an important factor in the company's financial function. Every decision to allocate capital into investment proposals whose benefits will be realized in the future must be carefully considered by the company [15, p. 1028]. The company is a combination of real asset values and investment choices in the future (Smith and Watts in Setiarini, 2006: 84). Company growth is a factor that is expected by investors so that the company can provide the expected returns. The company's growth which is always increasing and the increase in asset value is expected to encourage expectations for investors because of investment opportunities with the expected benefits that can be achieved.

The investment decision will have an impact on sources and financing where the funding sources can be obtained from internal in the form of retained earnings or external companies that can be in the form of debt or issuance of new shares. The company will tend to use internal funding sources first to pay dividends and if it requires external funding, the company will use debt before the issuance of new shares (Kagzi et al., 2018).

Investment decisions can be measured by using a price earning ratio, where this ratio shows a comparison between the closing price and earnings per share or with the following formula (Brigham, 2011):

$$PER = \frac{\text{Closing price}}{\text{Earning per Share}}$$

g. Funding Decision

Funding decisions can be interpreted as decisions regarding the company's financial structure. The company's financial structure as a composition of funding decisions that can include short-term debt, long-term debt and own capital. Every company wants a capital structure that can certainly maximize the value of the company and can minimize the cost of capital issued by the company [16, p. 1].

According to [2, p. 819] funding decisions are the strategic nature of corporate management. It can be said to be strategic because this decision has an impact on business continuity, business competition, financial management and cash flow as well as the image of the financial market. There are two views regarding funding decisions. The first view is known by the traditional view that capital structure influences the value of a company. The traditional view is represented by two theories, namely Trade off Theory and Pecking OrderTheory. The second view is stated that the capital structure does not affect the value of the company.

[16, p. 1] found that there was an increase in abnormal returns a day before and after the announcement of an increase in debt proportions, on the contrary there was a decline in abnormal rates when the company announced debt proportions. [16, p. 1] also found that the company's stock price rose if a loan was used upfront to buy back the company's shares. If using funds originating from debt, it is clear that the funds have costs, at least as much as the interest rate, but if you use equity capital, then you still have to consider the opportunity cost for your own capital.

Arrangement between which combination of capital sources will be taken, then certain considerations of the company are needed. Therefore, funding policy is a policy that discusses the source of funds that will be used to finance an investment that involves the optimal combination of the use of various funding sources. Some companies assume that the use of debt has a minimal level of risk compared to the issuance of new shares.

In choosing a funding source, whether sourced from within or from outside the company, Pecking Order Theory establishes a sequence of funding decisions where the first-time managers will choose to use retained earnings. Debt and issuance of shares are the last choice to increase their capital. This theory is based on the argument that the use of retained earnings is cheaper than external funding sources. The use of external sources of funds through debt will only be used if investment needs are higher than internal funding sources.

If external financing is required, the company will issue the safest securities first, starting from the issuance of bonds and then followed by option-style securities (convertible bonds), and finally the issuance of new shares if it is still insufficient. [2, p. 819] found that investments generated from leverage have positive information about the company in the future and then have a positive impact on the value

of the company. [1, p. 1] found that funding decisions affect the firm's value positively by 16%. Wahyudi and Pawestri (2006) found that funding decisions did not affect the value of the company.

According to [3, p. 89] funding decisions are confirmed through Debt to Equity Ratio (DER), which is a comparison between financing and financing through debt with funding through equity, which can be formulated as follows:

$$DER = \frac{\text{Total Debt}}{\text{Total Equity}}$$

h. Dividend Policy

Dividend policy is determining how much or the proportion of profits to be distributed as dividends [16, p. 1]. In designing and implementing the policy there is a trade off that must be considered. The policy on dividend payments is a very important decision in a company. This policy will involve two parties who have a different interest, namely the first party is the shareholders and the second party is the company. Dividends are defined as payments to shareholders by the company for the profits that have been obtained. If management increases the portion of the profit of one share that has been paid as dividends, then they can improve the welfare of the shareholders. It suggests that the dividend decision is a decision whether the profits earned by the company at the end of the year will be shared with the shareholders in the form of dividends or used to increase investment capital in the future.

Dianggao's dividend policy is a decision relating to the management and use of profit that is the right of every shareholder, and later the profit is divided as retained earnings for investment [12, p. 1002]. Dividends are compensation received by shareholders, in addition to capital gains. The value and time of dividend payment is determined at the General Meeting of Shareholders (GMS) and the value distributed can range from 0 to the amount of net income for the current year or last year. [16, p. 1] stated that dividends are part of the company's profits that will be distributed to shareholders. The amount of dividends to be distributed is proposed by the Board of Directors and agreed at the GMS. Dividends can be distributed in cash (cash dividends), other assets (dividend property), notes dividend, or stock dividends. Dividend policy will be recognized based on consideration of the interests of shareholders and also the interests of the company.

Dividend policy as a decision relating to dividend payments to the company, where the size of the dividend distributed depends on the retained earnings balance for the benefit of the company. Dividend policy can be proxied by the following dividend payout ratio [3, p. 89]:

DPR = DPS : EPS

Information:

DPR = Dividend Payout Ratio

DPS = Dividend per Share (Dividend Per Share)

EPS = Earnings per Share (Earning Per Share)

According to [13, p. 1], dividend policy is important for two reasons. Payment of dividends will affect stock prices and retained earnings (retained earnings) are usually the biggest and most important source of additional capital for the company's growth. Both of these reasons make the dividend policy must be decided carefully and carefully so that the two reasons can be fulfilled optimally. There are three theoretical views commonly used as a basis for determining dividend policy. The three theories are as follows:

a. Dividend Irrelevance Theory

The main supporters of this theory are Merton Miller and Franco Modigliani (MM). They argue that the value of a company will depend only on the ability of the company to profit from the company's assets, not on how the profit will be divided into dividends and retained earnings.

b. Bird in the Hand Theory

This theory was coined by Myron Gordon and John Lint-ner who argued that dividend distribution had a positive influence on firm value. This theory refers to the concept of time value of money where current dividends should have a higher value than future capital gains.

c. Tax Preference Theory

This theory states that actually dividend distribution harms investors. This is because there are taxes that must be paid when dividends are distributed. It's different with capital gains that don't need to pay taxes until the stock is sold. In accordance with the concept of time value of money, the tax payment in the future is more profitable than the current tax payment with the same amount. The dividend policy commonly carried out by companies is cash dividends. According to [13, p. 1], there are several forms of cash dividend policy. The form of the policy for giving dividends is:

a. Stable dividend policy

This policy will provide a permanent dividend per share for a certain period even though the company's profit fluctuates. This stable dividend will be maintained for several years and then if the profit gained increases steadily and stably the dividends will also be increased to be maintained for several years.

a. Increased dividend policy

With this policy, the company will pay dividends to shareholders with an ever increasing amount with stable growth. For example, the growth is set at 5%.

b. Dividend policy with a constant ratio

This policy gives dividends, the amount of which follows the amount of profit obtained by the

company. The greater the profit obtained the greater the dividends paid, and vice versa. The basis that is often used is often called the dividend payout ratio.

c. Low and extra dividend dividend policy

This policy determines the amount of dividend payments per sheet that is distributed small, then added with extra dividends if the profit reaches a certain amount.

Dividend policy chosen by the company must of course pass careful consideration so that there will be no problems for the company in the future. According to [3, p. 94], the factors that influence the size of the dividend to be paid are:

a. Position of Company Solvency

If the company under insolvency or solvency conditions is not profitable, the company usually does not distribute profits. This is because the profit obtained is more widely used to improve the position of its capital structure.

b. Company Liquidity Position

Cash dividends are cash outflows for the company. Therefore, if a company pays dividends, it means that they have to provide enough cash and this will reduce the level of company liquidity. Companies with poor liquidity tend to pay smaller dividends compared to companies with better liquidity.

c. Need to pay off debts

The more debt that must be paid, the more funds must be provided. Besides that with the maturity of debt, the debt fund must be replaced. Alternatives to replacing debt funds can be by finding new debt or by sources of internal funds by increasing retained earnings. This will certainly reduce Dividend Payout Ratio (DPR).

d. Expansion Plan

The faster the expansion carried out, the greater the funds needed. These funding needs can be met either from debt, increasing their own capital, or from internal funding sources by increasing retained earnings which will ultimately reduce the Dividend Payout Ratio (DPR).

e. Investment Opportunities

The more open investment opportunities, the smaller dividends will be paid because the funds will be used to obtain the investment opportunity.

f. Income Stability

Companies that have stable income do not need to provide a lot of cash just in case, whereas companies that have unstable income must provide a lot of cash just in case. This result in companies whose income is not stable will reduce its Dividend Payout Ratio.

g. Supervision of the Company

Sometimes the owner does not want to lose control of the company. Therefore, companies tend to look for sources of funds from their own capital. The possibility of entering a new investor will certainly reduce the control of the old owner of the company. If you spend from debt the risk is quite large. That is what causes companies to tend not to distribute dividends. [11, p. 373] found that dividend policy has a positive effect on firm value

$$DPR = \frac{DPS}{EPS}$$

3. RESEARCH METHODS

This research is a quantitative research. Quantitative research is structured research and quantifies data to be generalized. The data source used in this study is secondary data. Data collection techniques used in this study is documentation [14, p. 87]. The documentation method is carried out by collecting secondary data and all necessary information and the Indonesia Stock Exchange (IDX) which can be accessed on the www.idx.co.id. The data collected in this study is secondary data in the form of annual reports, annual financial reports issued by the company through the official website www.idx.co.id.

In this study the manufacturing companies that were sampled were banks that were listed on the Indonesia Stock Exchange in 2013 to 2016 totaling 34 companies.

No	Code	Companies
1	ARNA	PT. Arwana Citramulia Tbk
2	ALDO	PT. Alkindo Naratama Tbk
3	AMFG	PT. Asahimas Flat Glass Tbk
4	ASII	PT. Astra International Tbk
5	BRNA	PT. Berlina Tbk
6	BTON	PT. Beton Jaya Manunggal Tbk
7	CPIN	PT. Charoen Pokphan Indonesia Tbk
8	EKAD	PT. Ekadharma International Tbk
9	IGAR	PT. Champion Pasific Indonesia Tbk
10	INAI	PT. Indal Aluminium Industry Tbk
11	INTP	PT. Indocement Tunggal Prakasa Tbk
12	JPFA	PT. Japfa Comfeed Indonesia Tbk
13	LION	PT. Lion Metal Works Tbk

No	Code	Companies
14	AUTO	PT. Astra Auto Part Tbk
15	MAIN	PT. Malindo Feedmill Tbk
16	SIPD	PT. Siearad Produce Tbk
17	SMCB	PT. Holcim Indonesia Tbk
18	SMGR	PT. Semen Gresik Tbk
19	SPMA	PT. Suparma Tbk
20	TKIM	PT. Pabrik Kertas Tjiwi Kimia Tbk
21	TOTO	PT. Surya Toto Indonesia Tbk
22	TRST	PT. Trias Sentosa Tbk
23	DVLA	PT. Darya Varia Laboratoria Tbk
24	POLY	PT. Asia Pacific Fibers Tbk
25	PTSN	PT. Sekar Laut Tbk
26	GJTL	PT. Gajah Tunggal Tbk
27	ICBP	PT. Indofood CBP Sukses Makmur Tbk
28	IKBI	PT. Sumi Indo Kabel Tbk
29	IMAS	PT. Indomobil Sukses International Tbk
30	INDF	PT. Indofood Sukses Makmur Tbk
31	INDR	PT. Indo Rama Synthetic Tbk
32	INDS	PT. Indospring Tbk
33	MRAT	PT. Mustika Ratu Tbk
34	MYOR	PT. Mayora Indah Tbk

4. RESULT AND ANALYSIS

a. Multiple Linear Regression Test

Coefficients[a]				
Model		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	2.886	.914	
	KI	.648	1.949	.029
	PER	.051	.128	.035
	DER	.278	.239	.101
	DPR	.026	.355	.006
a. Dependent Variable: MBR				

Based on the table above, the regression equation is obtained as follows:

Y = 2,886 + 0,648 X1 + 0,051 X2 + 0,278 X3 + 0,026 X4 + e

The regression equation means that:

1. If the board of commissioners (X_1) raises one unit, the value of the company (Y) will increase by 0.648 units assuming another variable is constant.
2. If investment dicision (X_2) rises one unit, then what happens is the firm value (Y) will increase by 0.051 units with the assumption that other variables are constant.
3. If financing decision (X_3) raises one by one, the firm value (Y) increases by 0.278 units assuming another variable is constant.
4. If the dividend policy (X4) rises by one unit, then the firm value (Y) rises by 0.026 units assuming a constant variable.

b. Coefficient Determination

R	R Square	Adjusted R Square	Std. Error of the Estimatet
.487	.429	.177	2.17227

From the calculation data above obtained information that obtained R value of less than 50%, namely 48.7%. Simultaneous determination value (r square) of 0.429 means that the national diversity variable of the board of director, investment decisions, funding decisions, dividend policy of the company value changes 42.9% while the remaining 57.1% is influenced by other variables not examined.

a. a. F test (simultaneous test)

df	Mean Square	F	Sig
4	7.780	3412	.008

From the table above, it is known that the Fcount value is 3.412 and Ftable is 2.440282. Thus it is proven that Fcount is greater than Ftable which means that Ho is rejected and receives Ha at a significance level of 0.008. From these results, there is a significant influence on the national diversity variables of the board of directors, investment decisions, funding decisions, dividend policies together (simultaneous) on the value of the company.

d. T test (partial test)

Model		T_{test}	Sig
1	Constant	3,157	0,002
	CI	2,333	0,007
	PER	2,395	0,035
	DER	2,816	0,002
	DPR	,722	0,094

Degree of freedom (df) = (n-k-l) = 136-4-1 = 131 with a level of confidence level of 5% or 0.05, then the value of t table is 1.97824. The explanation for each variable is as follows:

1. The tcount in this study for X1 is 2.333 with a significance level of 0.07 greater than t table 1.97824 so that Ho is rejected. The results of the study inform that independent commissioners are in line with the value of the company

2. The tcount in this study for X2 is 2,395 with a significance level of 0,035 or greater than the table 1,97824 so that Ho is rejected. The results of the study prove that the investment decision affects the value of the company.

3. The tcount in this study for X3 is 3.816 with a significance level of 0.009 or greater than t table 1.97824 so that Ho is rejected. The results of the study suggest that financial decisions affect the value of the company

4. The tcount in this study for X4 is 0.722 with a significance level of 0.094 or smaller than the table 1.97824 so that Ho is accepted. This study also informs that dividend policy does not affect the value of the company.

Based on the results and analysis of research data, it shows that simultaneously, it can be seen that nationality board of director, investment decision, financing decision, and dividend policy together have a significant effect on the value of the company with a significance level of 0,000 smaller than 0.05 or 100% have a significant effect on the value of the company. The results of this study are in line with the research conducted by [16, p. 1]. Research conducted on manufacturing companies in the 2007-2009 period shows the results that simultaneously the LnPER, LnDER, and LnDPR variables have a significant influence on the firm's value. Strengthened by the results of research conducted by [16, p. 1], which obtained the results that investment decisions, funding decisions, dividend policy have a positive and significant effect on the value of the company.

Analysis of company value in the stock market has many uses, one of its uses for investors who are buying shares is that investors can see the development of the company's value and see which company's initial shares have more promising future prospects. The aim of investors is certainly to get high profits. It means the company needs to pay attention to its performance to remain competitive. [1, p. 4] the value of a company is basically measured by several aspects, one of which is the company's stock market price.

Based on the research it can be concluded that nationality board of director, investment decision, financing decision, and dividend policy have a significant influence on the value of the company. Partial test results or t tests that have been carried out obtain the following results:

1. The influence of the national diversity of the board of directors on the value of the company

Variable foreign commissioners have a significant effect on company value. This result shows how many foreign directors or directors in the company have a role in increasing the value of the company. The results of this study are in line with the opinion of [15, p. 1028] which states the role of the board of the company is related to the role of control, especially if it comes from countries with strong shareholder rights.

The results of this study are in line with the research conducted by [1, p. 1] which in their research obtained higher results or the more members of foreign commissioners, the higher the value of the company. With the duties and authorities possessed by a board of commissioners, as well as the advantages of a foreign councilor, the nationality of the board members of the company is said to have an influence on the value of the company.

2. Effect of investement decisions on firm value

Investment decision variables have a positive and significant effect on firm value. These results indicate that the investment decision opportunities made so far only look at the value of the company. A stable company value will certainly be more.

Investors are interested in investing. The results of this study agree with the research conducted by [13, p. 1] which in his research stated that investment decisions have a positive and significant influence on firm value.

Company growth is a factor that is expected by investors so that the company can provide the expected returns [19, p. 1]. The growth of the company which is always increasing and the increase in asset value is expected to encourage expectations for investors because of investment opportunities with the expected benefits can be achieved [20, p 409]. Another goal of the investment decision is not just to gain profits in the future, but to maximize the value of the company.

3. Influence of funding decisions (financing decision)

Variable decision financing (financing decision) has a positive and significant influence on firm value. This proves that the company's ability to pay obligations in the future has a market response. The results of this study are not in line with the research conducted by [13, p. 1] which in his research obtaining the results of funding decisions did not affect the value of the company.

The results of this study also agree with Famma (1998) to find that funding decisions positively influence firm value. Reinforced opinion [18, p. 71] funding decisions are a strategic trait carried out by company management. It can be said to be strategic because this decision has an impact on business continuity, business competition, financial management and cash flow as well as the image of the financial market.

4. Effect of dividend policy

Dividend policy variables have a positive and significant influence on firm value. The proportion of profit that will be distributed becomes the attention of investors to cooperate or invest. The results of this study do not agree with the research conducted by [16, p. 1] which in his research shows that the LnDPR variable does not have a significant effect on the value of the company.

In line with the results of research conducted by [19, p. 1], who obtained information that dividend, policy has a positive and significant effect on the value of the company. Supported by research conducted by [17, p.1857] and [18, p. 71], which obtained results that dividend policy has a positive and significant effect on the value of the company

5. CONCLUSIONS, SUGGESTIONS AND LIMITATIONS

Based on the results and analysis of research data shows that the simultaneous observation can be seen that the board of commissioners, investment decision, financing decision, and dividend policy together have a significant effect on the value of the company with a significance level of 0.008 which is smaller than 0.05 or 100% influential significantly against the value of the company. Research conducted on manufacturing companies in the 2007-2009 periods shows the results that simultaneously the LnPER, LnDER, and LnDPR variables have a significant effect on firm value.

Other results indicate that the board commissioner variable, investment decision, and financing decision are partially (individually) significantly influence the value of the company. The results of this study mean the role of the board of companies in relation to the role of control. The board of commissioners, investment decisions, and financing decisions partially (individually) had a significant effect on the value of the company. The result also investigate that a company has a foreign national council member and has broader experience, it will improve the performance of board members professionally. Coclusion shows that CFOs are possible to have an immediate impact on accounting decisions related to the company, such as choosing accounting methods and making accounting adjustments.

From the results of the data analysis, it can be concluded that the board of commissioners, investment decision, financing decision, and dividend policy simi- larly have a significant effect on the value of the company. While partially, only dividend policy that has no significant effect on the value of the company.

Suggestions obtained for the company, namely in conducting an IPO in the future, it is advisable to pay attention to the diversity of nationalities in the company as well as the distribution of assets, for investors before making an investment it is advisable to have a basis or understanding to analyze the possibilities that will occur.

This research has been endeavored and carried out in accordance with scientific provisions, but does not rule out the possibility of this study having limitations, namely: 1) factors that influence the value of the company in this study consist of four variables, namely the board of commissioners, investment decision, and financing decision, while there are still many more factors that can affect the value of the company, 2) there are some obsolance of research that has informed the companies should be reported their financial statement.

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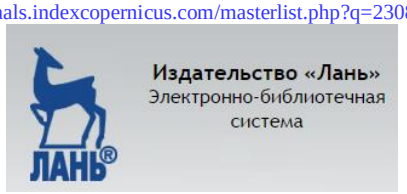

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Signed in print: 30.09.2018. Size 60x84 1/8

«Theoretical & Applied Science» (USA, Sweden, KZ)
Scientific publication, p.sh. 25.375. Edition of 90 copies.
http://T-Science.org E-mail: **T-Science@mail.ru**

Printed «Theoretical & Applied Science»