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Application of the Hardy-Weinberg law in the theory of social management

**KEYWORDS**
- anthropotechnocenosis;
- Hardy-Weinberg law;
- technocenosis;
- goal-oriented activity

**ABSTRACT**

*Introduction.* Currently, the number of functions performed by humans is gradually decreasing. Anthropotechnnosis is a system of relations, which is aimed at the production of objects of technology, and not at the reproduction of a person. Due to the unity of the laws of developing goal-oriented systems of activity, the laws that work in describing biological and social systems can be extended to anthropotechnocenoses.

*Materials and methods.* A mathematical model of the Hardy-Weinberg law is used, which is implemented in biology to describe the crossing of individuals of two different species.

*Results.* As the proportion of objects of technology increases (the formation of the anthropotechnocenosis), the proportion of social units decreases, and the frequency of interaction between them increases. The drop in the frequency of interaction is due to the fact that the number and role composition of the subjects of the relationship “human-object of technology” changes. There is a gradual transfer of functions to objects of technology that were previously performed by a person. In the “ideal case”, technology completely replaces a person. The model points to a very clear reason for the cyclical nature: the development of human ↔ operator relations.

*Discussion.* The Hardy-Weinberg law, adapted to the description of anthropotechnocenoses, allows rethinking the dynamics of Kondratyev’s cycles through the interaction of people and objects of technology. The obtained results can be used to receive basic data for a new scientific discipline – anthropotechnosociology.

INTRODUCTION

Modern theorists and practitioners of social management sometimes make mistakes due to the fact that the community – society – has long ceased to be just a system consisting of individuals and social groups. People live in anthropotechnocenoses.

According to the classical definition of social relations, given by an outstanding sociologist of the 20th century Sorokin, "all social life and all social processes can be decomposed into phenomena and processes of interaction of two or more individuals". Therefore, "the model of a social group can be only two or more individuals who are interacting with each other" [7, pp. 140–141].

Nowadays, the variety of operators (any objects of technology, methods, techniques, etc.) of technogenic origin has made the thesis obvious: a person is not so much a subject of social relations, but a standard element of socio-technical (anthropotechnical) systems. The number of functions performed in them by a person is gradually decreasing. This tendency is figuratively called "displacement of a person from the system" [8]. There are so many objects of technology that, probably, if the number of devices and the number of people who use them is calculated, then from decade to decade the "population" of objects of technology overtakes the human population. That is, such a system of relations as anthropotechnocenoses has developed on the planet, which is aimed rather at the production of objects of technology, and not at human reproduction.

The term "technocenosis" was introduced in 1973 by Kudrin [6], defining the elements of the technical environment of a person, fixed in space, forming peculiar communities of weakly connected and weakly interacting products by technocenoses (from ancient Greek κοινος – common). In contrast to the item-element, which is discretely distinguished, "the technocenosis is distinguished formally, conventionally, by agreement". Technocenosis is a system of technogenic origin, which is considered as a community of units of equipment, technology, material, products, and waste, classified by types.

The question is, why are these aggregates of products loosely connected? Because the mediator between them is still a person. He or she is still engaged in goal-setting in relation to these cenoses, that is, he or she is at the management level.

The analysis of the main socio-philosophical models of interaction between society and technology shows that in the 19th-20th centuries, a number of optimistic/pessimistic, alarming/indifferent ideas regarding the relationship between technology and further human development appeared.

Much attention was paid to the problem of the relationship "human-technology" in Marxism, while the dialectical relationship, the dialectical unity of these opposites is affirmed – they are tools for transforming nature in accordance with the needs of a human and the society. However, "smart" machines require an "intelligent" person.

Currently, some authors [12; 14; 15] write that there is a positive relationship between technological innovation and human development, while others [11; 13] believe
that the progress of technical capabilities is accompanied by a continuous process of dehumanization.

In 2000, it was shown that the relationship between a person and the operators used by them were in the nature of social relations, i.e., to achieve a certain goal, the interaction is not between a person ↔ a person, but a person ↔ an operator [4, pp. 39–50]. Indeed, the content (and typical development) of social relations ("a person ↔ a person") is very similar to the relationship between a subject and an operator, for example, an object of technology (see the table below).

<table>
<thead>
<tr>
<th>Social system (the relationship &quot;a person ↔ a person&quot;)</th>
<th>Anthropotechnical system (the relationship &quot;a person ↔ an object of technology&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The subject uses other subjects to achieve his or her goal. Often, their goal changes in the course of interaction, and a single goal of the formed community appears – the survival</td>
<td>The subject uses the technology to achieve a goal. Having got used to using this or that tool, the subject disaccustoms himself or herself of managing without it and must keep the equipment in working order, since only together they are effective</td>
</tr>
<tr>
<td>There is a social contract (explicit or implicit) between the subjects of relations, i.e., the rules of conduct that enable them to act effectively</td>
<td>The subject is forced to use the object of technology, following the operating instructions (explicit or implicit), so as not to break the equipment or (in some cases) not cause harm to his or her health</td>
</tr>
<tr>
<td>Those social groups (according to von Hayek) survive that can compete in their productivity with other groups, renewing their organizational structure when conditions of existence change</td>
<td>Part of the professions as ways of the existence of the dyad &quot;a person + an object of technology&quot; (for example, the crafts of nailers, barrel makers, churning makers and others) have died out, replaced by completely new forms of cooperation of people with tools</td>
</tr>
<tr>
<td>In organizations, some people are &quot;pushed out&quot; to the lower level of the hierarchy in order to perform the simplest functions (errand boys, slaves, messengers), while others are &quot;pushed out&quot; to the management level (managers)</td>
<td>When interacting with a person, some objects of technology require only their muscular strength, while others, on the contrary, only require the control action of a person (a modern electric drill rotates the drill itself, but it needs to indicate where and what to turn)</td>
</tr>
</tbody>
</table>

The list of analogies in the above-mentioned table can be continued. It is important that biosystems, social organizations, and anthropotechnical systems are goal-oriented or teleonomic*, and their activity is inextricably linked with the activity of living organisms: in all cases, there is a conscious or unconscious pursuit of some goal.

Hence an important conclusion for the manager: modern effective management is the control over the state of anthropotechnocenosis (global or local), which cannot be reduced to only personnel management. In this sense, managing any projects today is also mandatory for managing objects of technology: the relationships of a person ↔ an operator must be coordinated with each other, as well as the relationship of a person ↔ a person (see, for example, [6]).

Due to the unity of the laws of developing goal-oriented systems of activity (GSA) [3–5], the laws that work in describing biological and social systems can be extended to anthropotechnocenoses.

* From ancient Greek τέλος – goal, accomplishment. Goal-oriented systems are studied by teleological information theory developed by Korogodin in the late 1980s [4].
MATERIALS AND METHODS

It is suggested to consider the specific Hardy-Weinberg law, which is used in biology to describe the crossing of individuals of two different species (in conditions of their isolation from other species) [8; 9].

In 1908, the British mathematician Hardy and the German physician Weinberg independently discovered that, in an ideal population, the frequencies of genes and genotypes remained constant from generation to generation. Their mathematical model was one of the starting points of population genetics [10].

In its most general form, the law is written as a quadratic equation:
\[
a^2 + 2ab + b^2 = 1, \tag{1}
\]
where \( a, b \) – shares of two species, \( b = 1 - a \), i.e., other species do not affect their crossing; \( 2ab \) – the proportion of unions and associations between species.

RESULTS

The same model can be used to describe the interaction of social units \( a \) (individuals, families, groups of organizations) with objects of technology \( b \). At the same time, the objects of technology are understood broadly. These are objects developed not only by engineers but also by ordinary people ("naive engineers"), not only objects that make it possible to build machines and machine tools but also various kinds of inventory that allow creating and playing music, works of art, cooking food, making the daily routine easier, elective procedures, military operations and other goal-oriented practices of anthropotechnocenosis.

Fig. 1 shows the solution to equation (1). It can be seen that if \( a = 1 \), then the proportion of objects of technology is \( b = 0 \). As the proportion of objects of technology increases (the formation of anthropotechnocenosis), the proportion of social units decreases, and the frequency of interaction \( v \) between them increases. However, at \( a < 0.5, b > 0.5 \), the frequency drops again. The drop in the frequency of interaction is due to the fact that the number and role composition of the subjects of the relationship "a person-an object of technology" changes. There is a gradual transfer of functions to objects of technology that were previously performed by a person. Ideally, the technology "completely replaces a person" [2].

In a particular case, the frequency of interactions \( v \) is defined as:
\[
v = 2 \times \left( \frac{ab}{S} \right), \tag{2}
\]
where \( 0 < S \leq 1 \) is a parameter that determines whether the conditions are favorable for creating anthropotechnocenoses or not.

It is suggested to consider a situation in which the proportions of the elements that make up the anthropotechnocenosis, \( a \) and \( b \), change periodically in time, and the ratio \( b = 1 - a \) remains. Then the dependence of the frequency of interactions on time will be as shown in Fig.
2. At the same time, the authors considered the situation $S$ to be equally favorable during the entire time of the development of anthropotechnosism, i.e., $S = \text{const}$.

The use of simple tools by people means that $S \sim 1$, since almost everyone can learn and use them in everyday practice. However, with the development and complication of objects, fewer and fewer people are capable of both creating new objects of technology and using them. Moreover, the complication is increasing and requires more and more time to teach a person to handle objects of technology.

Another factor is the variety of modifications of the objects of technology that perform the same function, which also increases the time for users to master them. Therefore, it is proposed to complicate the model, assuming that the value of $S$ decreases according to the inverse exponential law, i.e., $S(t) = 1/\exp(t/c)$, where $c$ is a constant that determines the rate of complication in the creation and operation of the objects of technology. Then the dependence $v(t)$ will take the form of oscillations increasing in amplitude (Fig. 2, the solid line in the upper graph).

Figure 1 Solution to equation (1)

Figure 2 The cyclical nature of the interaction of people and objects of technology in the anthropotechnocenosis. Time is given in conventional units
The authors' model does not take into account the fact that the proportion of the objects of technology, as well as the proportion of people in anthropocenoses, cannot reach zero values (this would mean complete "extinction" of people or cyclical complete refusal of objects the technology by people). If this is taken into account, then the $v(t)$ dependence will take the form of oscillations increasing in amplitude and not reaching zero values (Fig. 2, the dotted line in the upper graph). It is noteworthy that this dependence has a clear similarity with the so-called Kondratyev's cycles (K-cycles or K-waves) – periodic ups and downs of the world economy [4], the presentation of which was first obtained empirically (1922). Schumpeter explained the K-waves by the activity of entrepreneurs (1939), Trotsky – by the class struggle (1923). There are other explanations, for example, related to political processes.

Meanwhile, the authors' model points to a completely clear reason for the cyclical nature: the development of relations a person ↔ an operator.

**Figure 3** The cyclical nature of the interaction of people and objects of technology in the anthropotechnocenosis, taking into account the complication of objects of technology. Time is given in conventional units.
**DISCUSSION**

Thus, the Hardy-Weinberg law, adapted by the authors to the description of anthropotechnocenoses, allows rethinking the dynamics of Kondratyev's cycles through the interaction of people and objects of technology. As a particular case, the obtained dependence $v(t)$ (Fig. 3) corresponds to a continuous series of innovations, or a change in technological structures, when a huge number of objects of technology become obsolete and are replaced by fundamentally new ones. Such a restructuring of the anthropotechnocenosis, for example, leads to waves of dismissals and a decrease in the people's standard of living, until new technologies are developed and the personnel is trained to use and reproduce them. Then people are again involved in them: consumers, testers, and maintenance personnel.

**CONCLUSION**

To describe the dynamics of the development of anthropotechnocenoses, the adapted Hardy-Weinberg law was used. It is shown that it can be used to explain the change of technological structures in anthropotechnocenoses. It is important that the cyclical increase in the interaction of people and objects of technology in the anthropotechnocenosis occurs – according to the model – only with an exponential decrease in factor S. This is important for the theory and practice of social management and means that as anthropotechnocenosis develops, the proportion of people capable of creating and managing the development of the objects of technology (in the total number of its components) is not growing – as it is commonly believed – but on the contrary, it is falling, although the total number of the population and objects of technology is growing.

This means that for the further cyclical development of anthropotechnocenoses with the complication of their structure for educating new specialists who ensure the development and renewal of the objects of technology, more expenditures and more time are required. I.e., from the point of view of education management, it is not the mass training of specialists that is required, but exclusively "individual", high-quality training. In addition, the training of personnel for public administration must necessarily include the training in the basics of developing technical systems, since the level of relations between people and objects of technology, as well as the degree of coherence of these relations, are prevailing in forming crises in the modern society. The society that is an anthropotechnocenosis.

The obtained conclusions can be used to receive basic data for a new scientific discipline – *anthropotechnosociology*. 

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Competing interests: The authors have declared that no competing interests exist.
O. A. Vasilyeva

Agro-food clusters in the Republic of Kazakhstan: assessment and prospects of development

KEYWORDS

cluster;
agricultural cluster;
cluster policy;
agricultural enterprises;
farms

ABSTRACT

Introduction. The relevance of the study is related to the fact that the formation of national clusters is one of the most essential tools to promote innovation and industrial development of the state economy. The objective of the article is to consider the peculiarities of the formation of cluster policy in the Republic of Kazakhstan and assess its development.

Materials and methods. Statistical data from the official website of the Committee on Statistics of the Republic of Kazakhstan, as well as scientific papers on the economic development of Kazakhstan and the EAEU countries, were used.

Results. The grain processing cluster of Kazakhstan is the basis of the agro-food cluster. In terms of grain production, Kazakhstan ranks third in the CIS after Russia and Ukraine. Wheat exports are one of the primary sources of foreign exchange earnings in the country’s economy.

The market share of Kazakhstan for most products in relation to the EAEU is from 5 to 15%. The highest shares are observed in the production/consumption of vegetables and gourd (22.48%), grain (14.34%), and milk (11.92%). The lowest shares of production are observed for the production/consumption of sugar (3.87%), fruits and berries (7.47%), eggs (8.76%), and meat (8.54%). Agro-food production in Kazakhstan increased by 1.04% from 2013 to 2018, while consumption increased by 0.60%.

By 2035, the capacity of the EAEU domestic market could grow significantly in the segments: meat and meat products (by 15%), milk and dairy products (by 17%), fruits and berries (by 39%), vegetables and gourd (by 24%), grain (by 12%) and oilseeds (by 69%).

Discussion and conclusion. The formation and development of territorial and sectoral clusters, mainly agrarian, will be one of the most effective forms of realization of the national competitive advantages of the Republic of Kazakhstan.

INTRODUCTION

Today, clusters are recognized as one of the most important tools for promoting innovative and industrial development, competitiveness, and the state economy's competitiveness.

A cluster is generally understood as a mutually beneficial cooperation of companies united to produce competitive, innovative products and services based on modern technologies and business models. The cluster approach is associated with creating new industries and services with a high level of added value and knowledge intensity, strengthening the state's competitive advantages in the world market.

Analysis of the world practice of cluster development shows that this approach has been widely developed in the strategies of many countries: the United States, the European Union, and Southeast Asia. According to experts, clustering currently covers about 50% of the economies of the leading countries of the world.

Practical experience in cluster formation shows that clusters are formed "from below" in innovative development and with the help of three components: science, business, and state support.

Following the Decree of the Government of the Republic of Kazakhstan of October 11, 2013, No. 1092 "On approval of the concept for the formation of promising national clusters of the Republic of Kazakhstan until 2020", clusters are recognized as an essential tool for promoting innovation, industrial development, competitiveness and efficiency of the state's economy [1].

The objective of the article is to consider the peculiarities of the formation of cluster policy in the Republic of Kazakhstan and assess the development of the agro-food cluster.

MATERIALS AND METHODS

The research materials were statistical data from the official website of the Committee on Statistics of the Republic of Kazakhstan.

Theoretical methods were used: analysis of works devoted to the economic development of Kazakhstan and articles of scientific periodicals: Studies on Russian Economic Development, Economic Change and Restructuring, Comparative Economic Studies, and Journal of Productivity Analysis.

LITERATURE REVIEW

The Republic of Kazakhstan is a Central Asian country that was formerly part of the Soviet Union. Kazakhstan has significant differences from other Central Asian
countries. It is a large state with a relatively small population density: 6.93 people per square kilometer.

Kazakhstan's secession from the USSR, i.e., its independent status, was a complicated process since the republic was 93% tied to the Soviet economy.

Johan F. M. Swinnen and Liesbet Vranken analyze changes in agricultural production in Central and Eastern Europe and the former Soviet republics since the beginning of the transition. Scientists state that almost all countries with economies in transition have begun to experience an initial decline in productivity over the past twenty years, and almost all countries are currently experiencing an increase in productivity [14]. These facts can be explained by the following circumstances.

In the mid-1990s, Kazakhstan experienced an economic recession. The country's economy was under the high inflation, imbalanced revenues and expenditures of the budget system, a sustainable budget deficit, rising energy prices, and an uncontrolled monopoly of producers. In 1995, the economy of Kazakhstan experienced a slowdown in the economic downturn and a significant reduction in the level of inflation, which was achieved with the help of monetary policy instruments.

The government of Kazakhstan used oil revenues to diversify the economy, and billions of dollars were used to implement the agricultural and food development program for 2003-2005 [12].

Quite a heavy blow to the Kazakhstan financial system occurred in 2008. For the first time since the global crisis of 2009, investment growth has accelerated in the republic. This was primarily due to the ongoing integration of the country into the EAEU, which ensures the free movement of capital, goods, and labor in its territory [6].

Agricultural financing is an essential aspect of economic reform in Kazakhstan. However, according to Gaisina, the state financial support of agriculture was sporadic, and the investment climate in Kazakhstan was not favorable for lending to the agricultural sector.

Kazakhstan's economy in 2013 was characterized by a gradual decline in the country's GDP growth rates, although continued to remain significantly higher than regional ones. The steady growth in consumption of the population exceeded 11% per year and roughly corresponded to the average growth in recent years. The number of consumers in the republic continued to increase due to population growth. In addition, a large grain harvest provided an increase in agricultural output by 10.8%.

Currently, Kazakhstan has national advantages in developing the agricultural sector, as it has the most suitable agricultural land, rich in highly qualified personnel. A significant contribution to the modernization of the agricultural sector, in the authors’ opinion, can be made by structural transformations through the creation of production clusters and the introduction of cluster technologies in the real agricultural sector, both at the local and regional levels.
FEATURES OF CLUSTER POLICY IMPLEMENTATION IN KAZAKHSTAN

Currently, cluster initiatives in Kazakhstan are an essential part of the country's industrial, regional, and innovation policy. They enhance the growth and competitiveness of clusters within regions that involve cluster companies, government, and academia.

Implementing a new cluster policy in Kazakhstan will create the basis for an innovative model of development and new competitive advantages of the domestic economy, increasing the competitiveness of basic and new sectors of the economy, small and medium-sized businesses, and sustainable development of the regions.

Clusters of the agro-industrial complex:
- Cluster Council chaired by the Minister of Agriculture of the Republic of Kazakhstan;
- integrator: NUH KazAgro Joint-Stock Company;
- Council members: the National Chamber of Entrepreneurs (industry association), industry research institutes, AEO Nazarbayev University, JSC SEZ PIT Management Company, universities.

The following key indicators of cluster performance are provided:
1. the amount of tax revenues to the state budget;
2. the share of the cluster's output in the total volume of the region's output;
3. cluster labor productivity;
4. the share of exports of cluster products and services in the total volume of non-resource exports;
5. the share of the cluster's goods and services sold in the total volume of the region's products sold;
6. EBITDA;
7. the net profit of enterprises;
8. the share of attracted investments for the development of cluster enterprises in the total investment volume of the region.

RESULTS

According to Table 1, the grain processing cluster of Kazakhstan is the basis of the agro-food cluster [11].

In terms of grain production, Kazakhstan ranks third in the CIS after Russia and Ukraine. Wheat exports are one of the primary sources of foreign exchange earnings in the country's economy.

For convenience, the data is presented in relative terms (see Table 2).
Table 1
Domestic production and consumption of the main types of agro-food products in Kazakhstan in relation to the EAEU (mln. tons)

<table>
<thead>
<tr>
<th>Agricultural products</th>
<th>Production, 2013</th>
<th>Consumption, 2013</th>
<th>Production, 2018</th>
<th>Consumption, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>18.23/120.48</td>
<td>12.81/89.49</td>
<td>20.27/141.80</td>
<td>13.76/100.89</td>
</tr>
<tr>
<td>Potato</td>
<td>3.34/35.37</td>
<td>3.35/36.38</td>
<td>3.81/33.93</td>
<td>3.71/34.60</td>
</tr>
<tr>
<td>Vegetables and gourd</td>
<td>4.95/22.83</td>
<td>5.94/26.66</td>
<td>6.22/25.72</td>
<td>6.08/27.91</td>
</tr>
<tr>
<td>Fruits and berries</td>
<td>0.28/4.78</td>
<td>1.13/12.94</td>
<td>0.39/6.12</td>
<td>1.20/13.44</td>
</tr>
<tr>
<td>Meat</td>
<td>0.87/10.85</td>
<td>1.14/13.21</td>
<td>1.06/13.24</td>
<td>1.30/13.70</td>
</tr>
<tr>
<td>Raw milk</td>
<td>4.93/43.49</td>
<td>5.62/49.81</td>
<td>5.69/45.93</td>
<td>6.12/48.22</td>
</tr>
<tr>
<td>Eggs (bln. pieces)</td>
<td>3.90/50.17</td>
<td>3.94/50.26</td>
<td>5.59/55.12</td>
<td>5.06/54.51</td>
</tr>
<tr>
<td>Sugar (beet)</td>
<td>0.01/5.19</td>
<td>0.46/6.76</td>
<td>0.08/7.11</td>
<td>0.50/6.81</td>
</tr>
</tbody>
</table>

Table 2 shows that the market share of Kazakhstan for most products in relation to the EAEU is from 5 to 15%. The highest shares are observed in the production/consumption of vegetables and gourd (22.48%), grain (14.34%), and milk (11.92%). The lowest shares of production are observed for the production/consumption of sugar (3.87%), fruits and berries (7.47%), eggs (8.76%), and meat (8.54%).

Agro-food production in Kazakhstan increased by 1.04% from 2013 to 2018, while consumption increased by 0.60%.

According to the calculations of Ksenofontov et al., Kazakhstan demonstrated dynamic growth of domestic consumption of almost all types of agro-food products. This is due to the growth of the population's real incomes and the increase in the country's population from 16.0 million people in 2008 to 18.4 million people in 2018. The growing domestic demand for meat products and fruits was primarily met by the expansion of import volumes. In other segments, except for the sugar market, the share of imports in domestic consumption remained relatively low [8].
In Kazakhstan, there has been a trend towards a moderate reduction in imports in recent years on the background of the development of domestic milk production (+1.05%). Kazakhstan is a major grain exporter. Up to 50-60% of flour production is sent to foreign markets. The bulk of the surplus grain and flour is exported to third countries.

According to the calculations of Ksenofontov et al., by 2035, the capacity of the EAEU domestic market can significantly increase in the segments: meat and meat products (by 15%), milk and dairy products (by 17%), fruits and berries (by 39%), vegetables and gourd (by 24%), grain (by 12%) and oilseeds (by 69%). The main contribution to the overall increase in domestic consumption of agro-food products will be made by Russia (50-80% for most products), due to its large share in the EAEU market, and Kazakhstan (15-30%) – due to the high expected dynamics of population growth and per capita consumption of basic food products [8, p. 166].

**DISCUSSION**

There are differences in mutual trade between the EAEU countries on almost all the selected products. As noted by the authors: "Most of them are related to the problems of the development of agricultural production in the EAEU under the influence of severe limitations on the part of domestic demand, due to the low purchasing power of the population's income and the gradual approach to the physical limits of saturation of the food needs" [9].

The high availability of grain in Kazakhstan contributed to the development of grain-intensive types of animal husbandry (mainly egg and broiler poultry). In the meat market, this may lead to a decrease in import volumes. At the same time, the consumption of poultry meat is still relatively low and has a high potential for growth in the coming years.

Paying attention to the cluster policy of Kazakhstan in general and agroclusterization in particular, the main signs of the creation of such clusters should be:

- integration and cooperation of agricultural firms, scientific institutions, and local and regional authorities based on new cluster technologies;
- innovations and new technologies in the organization and management of production, sales of products;
- financing of investments that can give new opportunities to agricultural formations in the competitive struggle.

Therefore, the formation and development of territorial and sectoral clusters, mainly agrarian, will be one of the most effective forms of realization of the national competitive advantages of the Republic of Kazakhstan. The creation of such agroclusters will become a strategic task of the state, and their effectiveness depends on the level of development of intersectoral relations, forms of interaction between enterprises, and mutually beneficial economic relations between partners.
CONCLUSION

Despite the low competitiveness of manufactured products and the underdeveloped infrastructure in the Republic of Kazakhstan, there are several competitive advantages: the possibility of expanding the raw material base, the availability of production capacities of processing enterprises, natural and climatic conditions for growing agricultural products, the ability to produce finished products in a wide range and provide the country’s population with high-quality products of domestic production.

REFERENCES


INFORMATION ABOUT THE AUTHOR

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The impact of COVID-19 pandemic shock on major Asian stock markets: evidence of decoupling effects

**Introduction.** Despite the start of the outbreak of the virus (COVID-19) was in December 2019, stock markets did not respond immediately as there was little information about the expected duration of the crisis and whether China would be able to contain it within a short period of time, and the risks entailing to the global economy due to the virus spread becoming pandemic that endanger the global health situation. As a result of the great uncertainty that prevailed among investors in the third week of February, stock markets around the world incurred trillions of US dollars in losses in a single week (ending February) seen as the worst week for financial markets since the 2008 global financial crisis. The initial purpose of this paper is to assess the reaction of major Asian stock markets to the early outbreak of COVID-19 pandemic and its spillover effects among these markets.

**Material and methods.** To capture switching behavior of major Asian stock markets due to the early outbreak of COVID-19, the paper uses daily price indexes of Shanghai composite, Hong Kong, Nikkei 225, and Korea stock market, during the period from December 2, 2019 to March, 13,2020. Markov switching dynamic regression (MSDR) employed to assess the behavior of each market to the response of the other markets’ behavior.

**Results.** Our finding indicate evidence of two states that distinguish the behavior of the stock markets during the early outbreak of the pandemic. In state 1, when the significance of the pandemic was not fully realized there was a strong link and influence between these markets, but in state 2, when the scale and size of the pandemic realized these markets displayed decoupling behavior. Results also indicate, Hong Kong and Nikkie stock markets were the epicenter in both states. The impact of the pandemic news on the behavior of these markets as indicated by the transition probabilities of state 2, varied from 3 days duration effect (Hong Kong) to 3 month duration effect (Nikkei 225).

**Discussion and conclusions.** The interactive association between these stock markets is important for investors as well as for policymakers. Increasing departure of stock prices from their fundamental driver, that is the common economic bonds linking these markets, implies increasing risk for investors in these stock markets. The duration of the shock as indicated by the transition probabilities show that Hong Kong stock exchange was the most resilient in the group, while Nikkei was the most reactive to the pandemic shock.

INTRODUCTION

The fast expansion of the coronavirus COVID-19, around the globe, nearly 200,000 infections in about 120 countries by February 4, have spread fear around the globe and disrupted the world economic activities, including capital markets, the nerve of the world economy. Despite the start of the outbreak of the virus (COVID-19) was in December 2019, stock markets did not respond immediately as there was little information about the expected duration of the crisis and whether China would be able to contain it within a short period of time, and the risks entailing to the global economy due to the virus spread and becoming pandemic that endanger the global health situation. As a result of the great uncertainty that prevailed among investors in the third week of February, stock markets around the world incurred trillions of US dollars in losses in a single week (ending February) seen as the worst week for financial markets since the 2008 global financial crisis. On this week China’s Shenzhen stocks incurred losses among major markets regionally as they closed sharply lower, followed by Nikkei 225, and then Hong Kong’s Hang Seng. On the first week of March due to stimulus measures declared by central banks, some of these markets rebounded and gained earnings that erased the previous week’s losses, but very soon again hit by another big losses. Central banks stabilization policies around the world took different directions in their attempt to avail the needed fiscal and monetary policy support. While the US Federal Reserve bank cut the interest rate to 1%. The European Central Bank, Bank of Japan and Bank of England announced readiness to respond to any negative impacts caused by the pandemic to safeguard financial stability of their markets. Chinese government approved 500 billion yuan ($71 billion) loans with low interest rates to small enterprises affected by the impact of the pandemic. However, all these moves by the central banks and governments to reassure investors around the world did little to calm fears, as financial markets resumed again their slide down after March second. To date, the virus outbreak is still expanding and causing global chaos that may disrupt economic activities in many countries around the world [16; 17; 18]. Till now, nobody knows how long will last the uncertainty hanging over the world economy [19]. Unfortunately, the feared biggest problem ahead, is shrink of global economic growth. The OECD has already warned that continuation of the outbreak could cut global GDP growth to 1.5%, sending a number of major economies into recession.

It is well documented in the literature that the effect of unexpected shocks to the real economy passes through stock markets. As stock markets fall, household wealth shrink and their saving increases leading into consumption decrease and then into economic depression. Such a negative impact expected to be very significant in the economies where individual households are highly connected with equity markets. COVID-19 seems potentially strong hit on global stock markets as investors became pessimistic about the repeated lockdowns of all activities [15]. Empirical research [1] documented that pandemics cause fear and panic among stocks market investors’. Similarly, expanding body of research (Carter [2]; Chen [3]; Nikkinen [7]; Kollias [10]; Papakyriakou [14], et al), have investigated the impact of terrorist attacks to
conclude that such exogenous shocks can send panic and fear among international investors. Chen and Siems [3], Nippani and Washer [8] show that pandemic effects have similar impact on capital markets as terrorist attacks.

This paper contributes to existing literature by filling the missing gap on assessing the early impact of COVID-19 on stock markets of countries where the epidemic initially started, and investigating their behavior as per reaction to each other’s behavior, and duration of the effects of the shock.

The interactive association between these stock markets is important for investors as well as for policy-makers in these countries. Increasing departure of stock prices from their fundamental driver, that is the common economic bonds linking these markets, implies increasing risk for investors in these stocks. The results in this paper can help us understand how these markets can react to common shocks that hit the global economies, and to comprehend the magnitude and scale of future pandemic crisis on major Asian capital markets.

**MATERIALS AND METHODS**

Markov-switching models (MSM) are extensively applied in finance, business and economics to capture switching behavior of capital markets and economic growth at periods of shocks (Garcia and Perron [4]; Kim, Nelson and Startz [9]; Guidolin [5; 6], Onour and Sergi [13]; Krolzig H.-M. [11], and on infectious disease outbreak detection (Lu [13], et al.).

MSM models are used for series displaying transition over a finite set of unobserved states, allowing the process to behave differently in each state. The transition time from one state to another and its duration is considered random. For example, these models can be used to indicate the process that controls the time at which stock markets respond to unexpected shock and duration under different states.

Consider the series \( z_t \), where \( t=1,2,\ldots,T \), is characterized by two states as in the following:

- **state 1**: \( z_t=\mu_1+e_t \)
- **state 2**: \( z_t=\mu_2+e_t \)

Where \( \mu_1 \) and \( \mu_2 \) are the constant terms in state 1 and state 2, respectively. \( e_t \) is a white noise error term with variance \( \sigma^2 \). The two states model shifts in the intercept term, and if the time of switches is known, the above model can be stated as

\[
z_t=s_t \mu_1+(1-s_t) \mu_2+e_t
\]

Where \( s_t \) is 1 if the process in state 1 and 0 otherwise. The above model can be estimated using dummy variables and Ordinary Least Square (OLS) estimation technique. But in our case because we don’t know in which state is the process at any time and therefore \( s_t \) is not observed then we cannot use OLS with dummy variables.

As a result, Markov-switching regression models (MSRM) designed to allow the parameters to change over the unobserved states. In the simplest form, we can state the MSRM as state-dependent constant term:

\[
y_t=\mu_s+e_t
\]
Where $\mu_s$ is the parameter of interest; $\mu_s = \mu_1$ when $s_t = 1$ and $\mu_s = \mu_2$ when $s_t = 2$.

Even though it is difficult to specify with certainty in which state the process lies at any point of time, but the probabilities of being in each state can be estimated. For that purpose, the transition probabilities in two states process of Markov chain can be stated as $p_{s_t s_{t+1}}$. For example, $p_{11}$ denotes the probability of being in state 1 in the next period given that the process is in state 1 in the current period. Similarly, $p_{22}$ indicate the probability of staying in state 2, while in state 2 in the most recent immediate period. Probability values closer to 1 imply more persistent process which remains at a given state for longer period of time.

Markov-switching regression models allow a quick adjustment after the process change from one state another, and their general specifications can be stated as:

$$z_t = \mu_s + x_t \alpha + y_t \beta_s + e_s$$

Where $z_t$ is the dependent variable, $\mu_s$ is the state dependent constant (intercept) term, $x_t$ is the vector of exogenous variables with state-invariant coefficient $\alpha$, $y_t$ is a vector of exogenous variables with state dependent coefficients $\beta_s$ and $e_s$ is independent and identically distributed error term.

**RESULTS**

The descriptive statistics in table 1 reveal significant changes in the four stock markets indexes after the outbreak of the virus after February 10, when the news spread in Asia and then to the rest of the world. The mean figures indicate the average daily losses of these markets during February 10 to March 13, and shows the most hardly hit market was Japan’s Nikki 225 which sustained about (-263) points in loss, and the highest median (-153) losses and volatility (400). Japan’s Nikki 225 reaction to COVID outbreak was even more stronger than the Chinese stock markets, Shanghai and Hong Kong, where the virus initially was detected. The standard deviation and the mini/max statistics show Nikki 225 and Hong Kong stock markets were the most volatile as losses in these two markets reached record levels of (-1128) and (-648) respectively. The numbers in the table also reveal that Shanghai and Korea stock markets are the most linked to each other, as the response of these two markets are almost identical in most statistics in the table, including the mean losses, volatility, skewness, and the mini/max statistics as well as the sum point losses. The figures 1-5, also reveal the association between these markets.

**Table 1**

Descriptive statistic of daily change

<table>
<thead>
<tr>
<th></th>
<th>Shanghai</th>
<th>Hong Kong</th>
<th>Japan</th>
<th>Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mean</strong></td>
<td>-4.26</td>
<td>-11.63</td>
<td>-263.93</td>
<td>-3.85</td>
</tr>
<tr>
<td><strong>median</strong></td>
<td>-3.54</td>
<td>18.75</td>
<td>-153.17</td>
<td>-0.78</td>
</tr>
<tr>
<td><strong>Std.dev</strong></td>
<td>49.36</td>
<td>322</td>
<td>400</td>
<td>33.15</td>
</tr>
<tr>
<td><strong>skewness</strong></td>
<td>-0.33</td>
<td>-0.06</td>
<td>-0.74</td>
<td>-0.38</td>
</tr>
</tbody>
</table>
Figures 1-3 reveal that based on stock markets reactions the period from the virus outbreak (February-10) to the second week of March can be segmented into two different states. The first state reveal the time period when the news of the pandemic announcement linked with a great deal of hope that China will be able to contain the virus spread, but soon after it became apparent that the virus has already spread to the rest of the world and may cause world economic downfall due to social containment and business lock out the second state started and governments in Asia and elsewhere pledged fiscal stimulus to avoid economic recession that feed capital markets collapse. These two states can be viewed from the plots of stock price changes included in the figures below.

Figure 1 indicate Hong Kong and Japan stock markets were closely linked to each other in the first state period, but then digressed from each other in the second state, which started from the first week of March.

![Figure 1](image1.png)

**Figure 1** Hong Kong (HSE) and Japan (JSE) stock prices fluctuations

Figure 2 show the behavior of Korean stock market to price change in Shanghai stock market in the two states period. It is apparent that change in Shanghai composite index and Korea stock prices were very closely associated in the first state period, as indicated by the systematic movements, but diverged from each other also by the first week of March, as in the case of figure 1.

Price fluctuations of Shanghai and Hong stock prices in figure 3, also reveal close association of the two markets in the first period (state 1), despite the higher volatility of Hong Kong stock price movements, compared to Shanghai stock price fluctuations. However, in state two which start from the end of the first week of March, the two markets started decoupling behavior (figures 1 and 2).
Figure 4 shows the behavior of Shanghai and Japan stock prices movements in the two states, and indicate that there is no clear (or significant) decoupling effect of the two markets, despite the high volatility behavior of Japan stock market compared to Shanghai stock price fluctuations. The behavior of the two markets prices indicate the positive association of the two markets have been maintained thorough out the two states. Figure 4 also indicate, despite the strong belief that the virus outbreak was initiated in main land China, the response of Shanghai composite index was far less than the other markets, in particular Japan stock market which responded more stronger than the rest of the markets.
Tables 2-5 investigate more formally, the dynamics of price change of the four markets using Markov switching dynamic regression (MSDR) that uses change in prices of each market as dependent variable and price change of the other remaining markets as independent variables during COVID-19 outbreak from 2 December 2019 to 13 March 2020. Estimation results of MSDR corroborate with the data plots of the figures 1-4, indicating that there are two distinct states, the state after the announcement of the virus but before realizing it a serious global threat, and the state when the virus outbreak was recognized as a global threat and this was the time when governments comprehended that the pandemic may cause a serious risk to the global economy, as it may roll on uncontrolled for uncertain period of time. Table 2, reveal the behavior of Shanghai stock market reacting to the behavior of the other markets. It shows that in state 1, only Hong Kong and Japan stock markets influence significantly and positively Shanghai stock market, but in state 2, while the impact of the two markets are significant, Japan still linked positively with Shanghai stock price changes, but Hong Kong and Shanghai decouple from each other in state 2 as the coefficient of Hong Kong market become negative. This is exactly what is portrayed in figures 3 and 4. This implies that after the pandemic outbreak, Hong Kong and Shanghai markets digressed from each other in state 2 as the coefficient of Hong Kong market become negative. The transition probability $p_{22}=0.92$, implies that duration of state 2 was about at least two weeks (13 trading days), that is the digression period of Hong Kong market from Shanghai stock market.

Table 3 assesses the behavior of Hong Kong stock market as response to the reaction of the rest of the markets to COVID-19 pandemic effects. It shows in state 1, Hong Kong market was significantly influenced by Korea stock market, but in state 2, started reacting to the news from Shanghai stock market, while diverting from Korea stock market behavior. The impact on Hong Kong market due to COVID-19 pandemic effect initially was significant, even though of short term, lasted only for 3 days, as indicated by the transition probability ($p_{22}=0.68$).
Table 2

Shanghai stock market

<table>
<thead>
<tr>
<th>Independent vbls</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State 1:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔHong Kong</td>
<td>0.18</td>
<td>0.02</td>
<td>0.000*</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>0.09</td>
<td>0.03</td>
<td>0.006*</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>0.62</td>
<td>0.59</td>
<td>0.29</td>
</tr>
<tr>
<td>Constant</td>
<td>-38.4</td>
<td>10.9</td>
<td>0.000*</td>
</tr>
<tr>
<td>State 2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔHong Kong</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>0.05</td>
<td>0.01</td>
<td>0.000*</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-0.13</td>
<td>0.13</td>
<td>0.34</td>
</tr>
<tr>
<td>Constant</td>
<td>9.27</td>
<td>3.63</td>
<td>0.01*</td>
</tr>
<tr>
<td>Transition probabilities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11 = 0.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P12=0.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P21 =0.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P22 =0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D(2,2)= 13 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N =67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3

Hong Kong SE

<table>
<thead>
<tr>
<th>Independent vbls</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State 1:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔShanghai</td>
<td>-3.96</td>
<td>2.42</td>
<td>0.10</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>-0.17</td>
<td>0.29</td>
<td>0.56</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>6.68</td>
<td>3.46</td>
<td>0.05**</td>
</tr>
<tr>
<td>Constant</td>
<td>-198</td>
<td>129.5</td>
<td>0.12</td>
</tr>
<tr>
<td>State 2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔShanghai</td>
<td>2.48</td>
<td>0.83</td>
<td>0.000*</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>0.02</td>
<td>0.12</td>
<td>0.82</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-0.75</td>
<td>1.83</td>
<td>0.67</td>
</tr>
<tr>
<td>Constant</td>
<td>78.9</td>
<td>46.6</td>
<td>0.09</td>
</tr>
<tr>
<td>Transition probabilities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11 = 0.26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P12=0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P21 =0.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P22 =0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D(2,2)=3 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N =67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results in table 4, reveal reaction of Korea stock exchange to responses of the other three markets, and indicate that Korea stock exchange was not showing any signs of being significantly influenced by any market in the group in the two states. The response of Japan stock exchange, in table 5 to the behavior of the other three markets, indicate that Nikkei was strongly associated with Shanghai stock exchange in state 1, but showed decoupling effect from all three markets in state 2. The transition probability p22=0.99, indicate the duration of state 2, which reflect its reaction to the behavior of the other markets expected to last at least about three months (100 days) from the start of state 2, that is the beginning of June-2020.
Table 4

<table>
<thead>
<tr>
<th>Independent vs</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State 1: ΔShanghai</td>
<td>0.04</td>
<td>0.02</td>
<td>0.11</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>-0.05</td>
<td>0.09</td>
<td>0.55</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-0.92</td>
<td>0.57</td>
<td>0.11</td>
</tr>
<tr>
<td>Constant</td>
<td>-5.95</td>
<td>18.8</td>
<td>0.75</td>
</tr>
<tr>
<td>State 2: ΔShanghai</td>
<td>0.002</td>
<td>0.01</td>
<td>0.83</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>0.001</td>
<td>0.01</td>
<td>0.89</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-0.028</td>
<td>0.06</td>
<td>0.67</td>
</tr>
<tr>
<td>Constant</td>
<td>1.52</td>
<td>3.2</td>
<td>0.63</td>
</tr>
</tbody>
</table>

Transition probabilities:
P11 = 0.20
P12=0.80
P21 =0.08
P22 =0.92
D(2,2)= 13 days
N =67

Table 5

<table>
<thead>
<tr>
<th>Independent vs</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State 1: ΔShanghai</td>
<td>0.28</td>
<td>0.22</td>
<td>0.21</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>6.96</td>
<td>1.18</td>
<td>0.000*</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-0.09</td>
<td>1.78</td>
<td>0.95</td>
</tr>
<tr>
<td>Constant</td>
<td>-268</td>
<td>63</td>
<td>0.000*</td>
</tr>
<tr>
<td>State 2: ΔShanghai</td>
<td>-0.03</td>
<td>0.11</td>
<td>0.75</td>
</tr>
<tr>
<td>ΔJapan</td>
<td>1.01</td>
<td>0.83</td>
<td>0.22</td>
</tr>
<tr>
<td>ΔKorea</td>
<td>-2.41</td>
<td>1.52</td>
<td>0.11</td>
</tr>
<tr>
<td>Constant</td>
<td>5.42</td>
<td>33.4</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Transition probabilities:
P11 = 0.96
P12=0.04
P21 =0.01
P22 =0.99
D(2,2)=100 days
N =67

*Significant at 1% significance level
**Significant at 5% significance level

**DISCUSSION AND CONCLUSIONS**

This paper investigates the impact of COVID-19 pandemic on stock markets behavior in major Asian stock markets, including Shanghai, Hong Kong (SEHK), Japan’s Nikkei 225, and Korea Stock price index (kospi), using Markov switching dynamic regression (MSDR) that uses stock price return of each market as dependent variable and price returns of the remaining
markets as independent variables during COVID-19 outbreak from December-2-2019 to 13-March-2020. Estimation results of MSDR, indicate there are two distinct states, the state at the announcement of the virus news but before realizing that it may become serious global threat, and the state when the virus outbreak was realized as a global problem and subsequent governments comprehension that the pandemic may cause a serious risk to the global economy, as it may roll on uncontrolled for unknown period of time. Results in the study reveal that Shanghai stock market in state 1, was positively and significantly reacted to Hong Kong and Japan stock price behavior, but in state 2, while the impact of the two markets was still significant on Shanghai stock exchange, Nikkei 225 remained a strong driver of Shanghai stock price changes, but fluctuation in Hong Kong stock price showed decoupling evidence as its coefficient become negative. This implies that after the pandemic outbreak, Hong Kong and Shanghai markets digressed from each other, but Nikkei still remained influential to Shanghai stock market. The transition probability p22=0.92, implies that duration of state 2 was at least two weeks (13 trading days), that is the digression period of Hong Kong market from Shanghai stock market.

However, the behavior of Hong Kong stock market as response to the reaction of the rest of the markets to COVID-19 pandemic effects, indicate in state 1, Hong Kong market was significantly influenced by Korea stock market, but in state 2, started reacting to the news from Shanghai stock market, and decoupling from Korea stock market price changes. The transition probability (p22=0.68) reveal that the digression from Shanghai stock market due to COVID-19 pandemic effect was short term, lasted only for 3 days.

Results in the paper also reveal reaction of Korea stock exchange to responses of the other three markets, and indicate that Korea stock exchange was not showing any signs of significant influence by any other market in the group in the two states. The response of Japan stock exchange, to the behavior of the other three markets, indicate Nikkei was strongly associated with Shanghai stock exchange in state 1, but showed decoupling effect from all three markets in state 2. The transition probability p22=0.99, indicate the duration of state 2, which reflect its reaction to the behavior of the other markets expected to last for three months (100 days) from the start of state 2, that is until the beginning of June-2020.

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Impact of inflation on economic growth in Pakistan

Ijaz Uddin

ABSTRACT

Introduction. High and sustained economic growth with low inflation is the central objective of the macroeconomic policy makers. Therefore, inflation has been one of the most researched topics in macroeconomics for the last many years because it has serious implications for GDP growth. The main aim of this empirical study to examined the relationship b/w (GDP) Gross Domestic Product Growth and inflation in Pakistan by using time series data from 1990 to 2015.

Methodology. This study apply (ADF) Augmented dickey fuller test for stationary, and then, Engel Granger Co-integration test, for short run and long run association.

Results. There is a strong positive and significance relationship between GDP growth and inflation in Pakistan. Which indicate that is a 1unit increase an inflation rate will caused by GDP increased by 0.27 unit.

INTRODUCTION

To attain sustainable economic growth coupled with price stability continues to be the central objective of macroeconomic policies for most countries in the world today. Among others the emphasis given to price stability in conduct of monetary policy is with a view to promoting sustainable economic growth as well as strengthening the purchasing power of the domestic currency [1].

Economic growth and the rate of inflation is central subject of macroeconomics policy. Among many variables that can be stated as the determinant of economic growth is inflation. However there is no a clear cut or straight forward decision about the relationship between economic growth and inflation. Researchers investigate about inflation and economic growth and have arrived come up with different views. It has been a controversial in both theory and empirical findings [2].

If inflation is indeed detrimental to economic activity and growth, then how low should inflation be? The answer to this question, obviously depends on the nature and structure of the economy, and will vary from country to country. Numerous studies with several theories have been carried out, which specifically aimed at examining the relationship between inflation and growth [3]


In this paper, we will examine inflation and its effect on economic growth in Pakistan.

LITERATURE REVIEW

Majumder [4] conducted a research the impact of inflation on economic growth in the event of Bangladesh, they were selected the time period (1975 to 2013). The used (ADF) Augmented dickey fuller test for stationary. This research thesis its independent variable (inflation, remittances, money supply) and while the GDP is dependent variable. The Author fined the results there is positive relationship b/w economic growth of GDP and inflation in Bangladesh.

Hossin [5] examined that inflation and economic growth relationship in Bangladesh. They used time series data from (1961 to 2013). They used the Granger causality test and also used
error correction model and co integration test. They finding is economic growth is positively affect inflation. If rises the inflation rate, then inflation effect economic growth negatively.

Umaru and Zabairu [6] analyzed the impact of inflation on economic growth and development in case of Nigeria. They were using time series data from (1970 to 2010). They are used Granger causality test and augmented dickey fuller test. They are finding results inflation not caused GDP but GDP caused inflation. The inflation is positive effect on economic growth and also encourage the productivity. The Author recommended the policy the Nigerian economy not increase their productivity it results the price level also low. This lead to Boom phase in economy.

Enu et el. [7] conducted a research that inflation rate and growth rate relationship, in the country of china. By using time series data from (1980 to 2012). They are using the (ordinary least square) OLS technique. They finding the results there is strong linear negative relationship b/w inflation and GDP, growth rate. If 1% decrease inflation rate caused by growth rate increased by 0.086%. In other case if 1% increase inflation rate caused growth rate decrease by 0.086%. These value are statistical significant at 5% level. The author recommended the policy to reduce the inflation to increase the growth rate.

Saaed and Afaf [8] examined the economic growth and inflation in case of Kuwait by using annul data for the period of (1985 to 2005). They are used error correction model and co integration test. They find there is long run negative significant relationship b/w GDP and CPI. The author say that conclusion is lead to Kuwait bank of monetary policy.

Ayyoub et al. [9] examined Do inflation impact the economic growth in the event of Pakistan. They used time series data for the period of (1973 to 2010). They are using the OLS technique. They conclude that there is significant negative relationship b/w economic growth and inflation in Pakistan. The author policy recommended the Stat bank of Pakistan is responsible to keep inflation less than 7% its results our economic growth is rises.

Shuaib et al. [10] investigated the inflation and its impact on economic growth in case study of Nigeria. They are used the time series data from (1960 to 2012). They are used the co integration test. They finding no co integration relationship b/w economic growth and inflation in given data. The author gives recommended policy the government lead to inflation rate one single digit number it is very necessary for a country.

Salian and gopakumar [11] the economic growth and inflation an empirical evidence of India for the period of (1973 to 2008). They are using augmented dickey fuller test and Philips-Perron test for unit roots, and co integration test. They find there is long run negative relationship b/w GDP growth rate and inflation.

Obi et al. [12] examined the inflation and economic growth in case of Nigeria for the period of (1981 to 2014) by using (2sls) two stags least square. The study conclude that inflation is beneficial for growth and while the significance of growth due to inflation. The final finding the negative relation b/w growth and inflation on the other hand positive relation b/w inflation and growth.
Vinayagathasan [13] conducted a research growth and inflation in case of 32 economies of Asia. They are selected time period from (1980 to 2009) by using regression analysis, they have created the endogeneity problem in the model. There finding inflation have 1% level of significance, if inflation have around 5.43%. The growth rate is affected due to inflation in strong. The author recommended that our results are beneficial for central bank.

Idalu [14] empirically investigated the inflation and its effect of economic growth in the event of Nigeria for the period of (1970 to 2013) by using vector autoregressive model. They find the result there is intersection b/w the variable quantity long run for five years. The results show that in one impermanent a price level for consumer shocks, which claims that low positive short run effect of GDP in Nigerian country.

Osuala et al [15] conducted the empirical study the effect of inflation on growth about in Nigeria. They are using the time series data from (1970 to 2011) by using (ADF) Augmented dickey fuller test and Philips perron test. The author finding economic growth and inflation have significance positive relation in case of Nigeria.

Barrio [16] has empirically study about economic growth and inflation in case of hundred countries for the period of (1960 to 1990) by using multiple regression technique. The result show that if increase average inflation 10 percent in per year, its results the reduction of GDP by 0.3 percentage.

Chaudhary et al. [17] analyzed empirically do inflation matter for sectorial growth in case study of Pakistan by using time series data from (1972 to 2010) by using OLS and 2SLS and autoregressive method. They finding results inflation is beneficial for manufacture growth there is positive relationship. And also show that inflation and agriculture sector have significance positively related.

Bandula et al. [18] conducted the empirical study the relationship b/w economic growth and inflation in the evidence of three Asian countries for the period of (1980 to 2010) by using (ADF) Augmented dickey fuller, granger causality test and co integration technique are applied. The author claim in case of Sarilanka there is long run negative relationship b/w inflation and economic growth. And also in case of India and china have no statistical relationship, the author claim this paper is important for policy makers.

Olu and Idih [19] examined the economic growth and inflation in the country of Nigeria. They selected the time period from (1980 to 2013). They are applied are OLS ordinary least square technique. There finding inflation rate have positive in significance effect on economic growth. They also claim if GDP increase the inflation also increase in this stage no positive effect of monetary policy to control inflation. The author recommended if monetary authority stabilized the inflation rate the economic growth itself betterment in Nigeria.

Ghosh et al. [20] analyzes the empirical study that economic growth and inflation in case study of Bangladesh. They selected time series data from (1978 to 2010) by using co integration test and ADF test are applied.

Wajid and Kalim [21] analyzed the effect of economic growth rate and inflation on unemployment in the event of Pakistan, for the period of (1973 to 2010) by using ADF and co
integration test. They find the results there is long run and short run negative relationship of economic growth effect on unemployment.

**RESEARCH METHODOLOGY**

*Universe of the study*
This study has been conducted in case of Pakistan to check the impact of inflation on economic growth in Pakistan.

*Research Hypothesis:*
Ho ≠ there is no relationship between inflation and economic growth.

*Source of data*
The data on inflation and GDP growth has been taken from WDI.

*Model Specification*
\[ GDPGR_t = \alpha_1 + \beta_1 INF_t + \varepsilon_t \]
Where, \( INF \): inflation; \( GDPGR \): Gross Domestic Product growth rate

*Definition of Variables*
\( INF \): the general and persistence rise in the general price level.
\( GDPGR \): It denotes the Gross Domestic Product growth rate of a country.

**RESULTS AND DISCUSSION**

Table 1
Results of ADF

<table>
<thead>
<tr>
<th>Variables</th>
<th>At Level</th>
<th>Prob.</th>
<th>1st Difference</th>
<th>Prob.</th>
<th>Stationary at</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPGR</td>
<td>-0.369301</td>
<td>0.1643</td>
<td>-1.137754</td>
<td><strong>0.0000</strong></td>
<td>I(1)</td>
</tr>
<tr>
<td>INF</td>
<td>-0.357863</td>
<td>0.2611</td>
<td>-1.262221</td>
<td><strong>0.0000</strong></td>
<td>I(1)</td>
</tr>
</tbody>
</table>

The above table show that both variables GDP and inflation are non-stationarity AT Level, but we are converted to 1st difference. In this case we have both variables such as GDP and inflation are stationary at 1st difference verifying the same level of integration, which allows us to used Johansen’s co-integration test and also used for short run employ Engel Granger Co integration.

*Engel Granger Co integration test:*
This study is based on Engel Granger co integration test, because all variables are stationary at 1st difference. Engel granger co integration are capable to confirm long run and short run relationship. We will proceed for short run relationship and if not, then there is no need to go for short runs relationship, which is based on (ECM) Error Correction Mechanism.
The above table 2 shows that the results of ordinary least square. There occur positive relationship b/w inflation and GDP. Displaying a one unit increase in inflation leads to 0.25 unit increase in GDP.

Null Hypothesis: there is no long run relation b/w inflation and GDP

In direction to find the short run relationship we applied error correction mechanism (ECM) the result obtained from ECM shows that there exist short run positive relationship b/w gross domestic product (GDP) and inflation in case of Pakistan. A one unit increase in inflation 0.27% unit increase in GDP having statistical significant relationship. Further, ECM (-1) shows that the speed of adjustment toward long run equilibrium, means that almost 60% of adjustment takes place every year toward equilibrium.

Further, 59% of variation in GDP caused by inflation in case of Pakistan and 41% variation caused GDP by other factors.
**Residual diagnostic test:**

### Table 5

<table>
<thead>
<tr>
<th>Cheeked</th>
<th>Tests</th>
<th>F-Statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normality</td>
<td>(Jarque-Bera)</td>
<td>0.486989</td>
<td>0.783884</td>
</tr>
<tr>
<td>Heteroskedasticity</td>
<td>Breusch - pagen</td>
<td>0.197093</td>
<td>0.8225</td>
</tr>
<tr>
<td>Auto Correlation</td>
<td>AR(1) AR(2)</td>
<td>------</td>
<td>---------</td>
</tr>
</tbody>
</table>

In the above 4.10 table the residual diagnostic test are applied for to checked out the error term, normality, hetrocedasticity and Auto correlation. To find out the Residual or error term results the following criteria.

### Table 6

**Hypothesis of Residual of ECM**

<table>
<thead>
<tr>
<th></th>
<th>Ho: Data is normal distribute.</th>
<th>Accept Ho.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarque-Bera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breusch - pagen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autocorrelation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table no 6, show that residual have normally distribution, which is desirable for Assumption of Residual. The null hypothesis of the normality, Jarque-Bera statistic is data is normal distributed and alternative hypothesis data is not Normal distributed, so we will accept the Null hypothesis. The second rows of the above table show that residual is constant variance meaning that data is Homoscedasticity. The null hypothesis of the Breusch – pagen test is data is homoscedasticity. So we will reject alternative hypothesis and accept the null hypothesis. The 3rd row show that data is No Autocorrelation, so if we see the table no 4.9 the Durban Watson statistics value which is 1.88, which is near to 2, so we will accept Null hypothesis and Reject Alternative hypothesis. The above result show that our model is successful and acceptable, because our model is clear the disturbance of model.

**CONCLUSION**

This empirical study determines the relationship between GDP growth rate and inflation rate in Pakistan for the period of 1990 to 2015. Our dependent variable is GDP and while inflation is independent variable. We are using (ADF) Augmented dickey fuller test for stationary, our variable, inflation and GDP AT Level non stationary, after 1st difference our variable is stationary. After using Johansson co integration test, and Engel Granger co integration methods to find the long run as well as short run association b/w inflation and GDP growth rate in case of Pakistan. Hence proved that there is a strong positive linear relationship between GDP growth rate and inflation rate in Pakistan.
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A. A. Maiorov

Management of a higher education institution and ways to implement effectively its innovation policy

KEYWORDS

education; management; information technology; management technologies; innovative technologies

ABSTRACT

Introduction. The utilization of innovation activity mechanisms increases the competitiveness and quality of educational services. The necessity to develop an innovative environment, to intensify the innovative activity of higher education institutions determines the relevance of research in the field of innovative management.

The purpose of the article is to identify ways to implement effectively the innovation policy of a higher educational institution.

Materials and methods. A theoretical analysis of research materials (data of ratings of technological innovations in education, publications in periodicals, conference proceedings, and analytical materials) was used.

Results. The main innovative educational factors and technologies were identified: educational virtual and media technologies, human resource management, balanced scorecard as an innovative technology, bimodal educational systems.

Discussion. The main functions of the educational knowledge management system are in solving interrelated problems: in the formation of innovative and self-learning corporate human capital; in social conditions, within which this capital realizes itself in the creation of innovations demanded by the market and other consumers in the form of educational products.

INTRODUCTION

The development of education is required to solve the problems of socio-economic development of states and is one of the highest priorities.

The economic conditions of many countries lead to the necessity of financial self-sufficiency of higher education institutions (HEIs). This is due to a decrease in state funding for scientific research and educational programs.

Many HEIs strive for the commercialization of educational and scientific activities and for the ability to create and use the results of scientific and technical creativity. Educational and scientific products manufactured by an HEI must be innovative and competitive.

The utilization of innovative activity mechanisms increases the competitiveness and quality of educational services. A modern HEI is able to ensure the promotion of innovative projects from a concept to implementation independently or in association with other HEIs or commercial enterprises. Solving the problem of increasing the efficiency of education necessitates the development of a strategy for optimizing the management control over an HEI. Consequently, modern activities of HEIs must organically include innovative activities. Modern trends in the development of higher education reflect the transition of HEIs from the classical model of education to an innovative model of education. The problem of managing innovative processes in the educational environment arises in connection with these trends. By transforming the typification of innovations [1] into education, it is possible to single out the following factors influencing the innovation and innovation management: organizational, technological, motivational, informational, intellectual, and technical. The need to develop an innovative environment, to intensify the innovative activity of HEIs determines the relevance of research in the field of innovative management.

The purpose of the article is to identify ways to implement effectively the innovation policy of a higher educational institution.

MATERIALS AND METHODS

as well as analytical materials and conference proceedings, were used as the materials of the study.

**SOURCES**

Unfortunately, nowadays it is typical when any new or even old technology is associated with the term "innovative" and innovation is announced formally. There is a practice to call any new development an innovation without analyzing its characteristics and moreover, the properties defining it as an innovation.

A number of websites have appeared on which various ratings of innovations in education are published. For example, a list of six best technological innovations capable of major changes in education is published on the website of the Advanced Micro-Electronics company:

1. Virtual reality (VR) in education. With VR, students can learn while interacting with the 3D world.
2. Artificial intelligence and machine learning. Adaptive programs considering the individual needs of students have been developed due to machine learning. Artificial Intelligence Tutors have been designed to educate students.
3. Cloud computing for education. This technology grants access to educational resources from anywhere in the world.
4. 3D printing. 3D printing is used for developing prototypes by prospective engineers and designers in HEIs.
5. Social networks in educational institutions. Students use them to share information with other students and teachers as well.
6. The use of biometrics in schools. The introduction of biometric systems in schools is utilized to monitor student attendance [2].

The Spring Wise website has published the TOP 7 innovations in education (2020). Let us consider the first three innovations in the article.

1. The iClassroom virtual classroom is used to enhance virtual learning during the COVID-19 pandemic. The platform allows learning communities to interact with each other, share resources, and track progress in selected courses without the need for multiple communication tools.
2. Free street lessons for children from low-income families who do not have access to the Internet or cannot afford digital learning tools.
3. "School-tree" modular educational center, consisting of two circular buildings that combine internal and external space. Classrooms are well ventilated and social distancing is achieved through the extra spaces included in the design [3].

In foreign countries, the Oslo Manual is used as a fundamental document. Let us consider the difference between the concepts of novation and innovation [5] in
accordance with this guideline adopted by the Organization for Economic Co-operation and Development (OECD) [4].

An obligatory property of innovation is novelty. This means that the main four types of innovations: product, process, marketing, or organizational must be new in relation to the known and applied developments. However, this property is not the only one. Many objects with this property are not innovations, but novations.

**Novation** is a kind of pioneer product that did not exist before. According to civil law, novation means an agreement of the parties to replace one obligation concluded by them with another obligation [8]. Novations are the most important components of innovations, but they are not identical to them. Not every set of novations is also an innovation. Novation has a certain positive effect, but, as a rule, less in importance and scale than innovation. Let us define innovation from these positions as an integral set of novations that provide an additional effect to the sum of the effects of novations that make it up. An innovation differs from a novation in its larger scale, a larger effect, and the possible presence of a synergistic effect.

Innovation is new to a market (industry). In this case, an organization introduces an innovation that contains signs of innovation in its market (industry) for the first time. Innovation is at a global level when the organization first introduced the innovation to all markets and industries, both domestic and international. New in the world implies a qualitatively higher degree of novelty than new to the market. A situation should be noted when the creators of scientific or technological projects often unreasonably attribute to themselves the level of novelty, only because their project has not been previously applied in the industry or at the enterprise.

Modernization and optimization of managerial control over higher education require an analysis of experience and practical recommendations for HEIs in order to select the most effective and optimal solutions for the implementation of the developed strategy [6].

Sharma and Sharma propose a conceptual innovative structure for an educational institution to achieve competitive advantages over other HEIs and a high level of academic performance through the interaction of various innovations: innovative ideas and their implementation, teamwork, innovations in the educational process, management, cooperation, etc. [7].

According to Kravchenko et al., one of the tasks of a modern university is to develop the potential of all participants in the pedagogical process, providing them with opportunities to reveal their creative abilities. The authors distinguish the following elements of innovation in HEIs: target (increasing the efficiency of resource use in HEIs), contensive (processes of development and application of innovations), and effective (quality of training of the graduates) [8].

Zabolotniaia et al. consider the possibilities of application of the Moodle Learning Management System (LMS) tools to ensure the effective implementation of the innovation policy of a higher educational institution. According to scientists, Moodle LMS provides
a comprehensive educational process through extensive educational content, a system of control, monitoring, and assessment of the quality of knowledge [9].

Thus, the necessity to improve measures to modernize the management of HEIs in the university environment, to provide the informational and methodological support for specialists and administrative and management personnel involved in the modernization of management processes, as well as to improve the qualifications of specialists and management personnel in the field of modern university management, require appropriate justification. Such justification is possible on the basis of studying the practice and experience of existing management solutions using information and communication technology.

The main directions of innovative management in the field of education can be identified as follows:

- the HEI should have its own innovation policy in which all faculty members should take part;
- it is required to understand the role of the HEI in the innovation process;
- the HEI should create and enhance its innovativeness;
- the HEI should apply the innovative methods and technologies;
- the HEI should carry out research activities, obtain and formalize the result in a form suitable for subsequent commercialization; at the same time, the HEI should sell developments, not commercial products;
- the HEI should have a coordinating body that is responsible for innovation policy;
- the HEI should obtain and use the information educational resources for educational tasks;
- the HEI should develop technologies for obtaining and transferring knowledge in educational and management processes.

In the process of teaching and management, educational information models and educational information technologies are based on the use of information units as components of technologies and the basis of information resources.

RESULTS

Let us list the main innovative educational factors and technologies.

1. Educational virtual and media technologies

*Media education* – an innovative technosphere is considered as a significant factor in increasing the effectiveness of additional technical education, its role and place in the general system of modernized education. The technosphere is a part of the pedagogically organized space of vocational education institutions, the values of which are becoming modern technical means of information. *Media education* as an innovative *technosphere* is a relevant factor in modern education. The advantage of this approach is the ability to integrate a variety of media into one application, for example, sound, video, and text can be presented simultaneously on a Web page. A special type of media resource is virtual educational resources [10; 11].
2. Human resource management

The growth of the intellectual capital of the educational institution and the innovativeness of the staff and the HEI as a whole can serve as a criterion for the innovativeness of an educational institution. Personnel accounting is a formal procedure that does not reflect the innovativeness of personnel, the competitiveness of personnel and does not determine the relationship between the quality of education and personnel.

Increasing the competitiveness of an educational organization is possible through research and development of mechanisms for the formation of the competitiveness of an educational organization based on the organization of intellectual resources [12].

Intellectual factors are associated with the need for human resource (HR) management [13]. Many foreign organizations have the position of HR Director, Head of HR Department, or HR Manager. Russian education lacks such types of management. HR management and personnel management are essentially different technologies. It is HR and its management that create intellectual capital, which is not included in the field of personnel accounting and bookkeeping.

Intellectual capital should be taken as a new economic category that reflects the objective reality of an increase in the value of intangible assets partially amenable to accounting. Other factors of intellectual capital (highly qualified employee, work, pedagogical experience) are not accountable, moreover, they are not even the property of the organization that owns them. These factors affect the market capitalization of a company or the brand of an educational institution. The market value of such an organization exceeds the book value of fixed assets, material and financial assets. On the other hand, this situation creates additional difficulties in managing such capital, since a highly qualified specialist and brand carrier can leave the HEI.

HR management ensures the growth of personnel competencies. Competencies are the foundation of innovation. Competence determines the level and intellectual potential of the personnel and the enterprise. According to the EFE's “Glossary of labor market terms, standards development...” [14], there are four models for defining the competencies: a) based on personality parameters; b) based on the performance of tasks and activities; c) based on the performance of production activities; d) based on performance management. Each of the four competency models leads to different approaches to planning, organizing, and personnel management.

3. Balanced scorecard as an innovative technology

According to the experience, a balanced scorecard [15] developed as the personal balanced scorecard in terms of HEI management is the effective mechanism for HEI management and competitiveness improvement. Such an individual system makes it possible to consider the performance indicators of an organization and a person as an interconnected complex. A Personal Balanced Scorecard is currently considered as an effective method for coaching (mentoring, work with employees, including individual training and counseling) [16].
The special role of this method is to change the behavior of the educator in order to increase the efficiency of the HEI. The Personal Balanced Scorecard is considered as an integral part of the Total Performance Scorecard [17], which in turn includes the Organization Balanced Scorecard, talent management, Total Quality Management, and the Personal Balanced Scorecard indicators.

In its ideology, the concept of a Total Performance Scorecard can be considered a systematized process of continuous, step-by-step learning and development aimed at forming the competitiveness of both the individual and the personnel of the organization as a whole. The main components of this process – improvement, development, learning – are closely related and must balance each other.

The Balanced Scorecard is an innovative technology, as the set of indicators provides a synergistic effect, which is a characteristic of both novation and innovation.

4. Bimodal educational systems

Distance education and its methods become increasingly popular in modern education. Expanding the field of education requires the use and improvement of distance education methods. Some educational institutions practice only distance learning, others practice a combination of traditional and distance education (blended learning). The latter are called bimodal educational systems. In bimodal systems, distance education is integrated into the structure of the traditional educational model. Full-time and distance students can study with the same teachers, according to the same programs, and take the same, or similar, exams. As a matter of fact, "traditional" students often use teaching materials aimed at distance-learning students. In bimodal systems, teachers often assume the functions that are assigned to collectives in specialized systems.

In most bimodal educational organizations, distance education is managed and administered by a dedicated department of the organization. Compared to specialized systems, bimodal distance learning systems are used in a small area as a rule.

Bimodal educational systems are not just an additive application of traditional and distance education methods, but an optimal combination of technologies based on the specifics of the university and the integration of its academic disciplines. It is these systems that provide a synergistic effect and are innovative.

DISCUSSION

It is misguided to reduce innovation management only to the creation of technological innovations. The innovativeness of an educational organization as the basis for obtaining innovations and innovative methods in education is a more important indicator.

Innovation includes innovation potential and innovative resources. It is necessary to distinguish between innovation potential and innovation resources.
Innovation potential is a complex that includes the states of the elements of the innovative resource base, a set of methods and means for obtaining innovative resources and subsequent innovative activities. Assessment of innovative potential is a quantitative measure of the possibility of creating innovative resources and performing innovative activities using available innovative resources. Innovative potential serves as the basis for obtaining a resource.

Innovative resources are sources and prerequisites for obtaining innovations that can be implemented with existing technologies and socio-economic relations. An innovative resource is a set of existing relationships, means, and opportunities for creating innovations. The innovation resource serves as the basis for the implementation of innovation.

The end product of an educational institution, acting in the form of an educational service, is not only a function of the direct professional knowledge and competencies of the heads and staff of the HEI, but an integral result of social, institutional, and other knowledge of the HEI. Therefore, the existing approaches to the management of educational knowledge are closely related to the cognitive model of the human capital of the enterprise [18].

The main functions of the educational knowledge management system are to solve two general interrelated tasks. First, to form innovative and self-learning corporate human capital, capable of high-speed creative labor, constructive "conversion". Second, to create social conditions within which corporate human capital of innovative quality can create the innovations demanded by the market and other consumers in the form of educational products.

**CONCLUSION**

The innovative management methods are becoming relevant for modern HEIs to ensure high-quality training. The need for innovative development, changes in the organization arises in any case, regardless of the target orientation adopted by the top management. This determines the utilization of innovative management as a set of measures to increase the competitiveness of education and improve the quality of it. Innovation is associated with the use of advanced methods and technologies and increases the level of education at the HEI. It is required to distinguish the HEI management and the knowledge transfer management. The basis of all of this is the concept of information units and integrated information technology. Moreover, the information resources for educational tasks are being organized in a new way. They are more structured and shaped using cognitive models. However, not all uses of information technology, management technology, bimodal systems, and virtual learning systems are innovative. They become such only when a synergistic effect is obtained.
REFERENCES


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