to better perform his main management functions and roles in the course of the enterprise economic activity.

2.9. Analysis og innovative development of higher education

Higher education is the basis of human development and progress. It promotesthe formation of intellectual, spiritual and production potential of a man. On the one hand, state development, structural changes at different economic levels should be harmoniously combined with education modernization to meet young people needs and aspirations, to establish a new set of values in public and private sectors[217].

On the other hand, due to education system innovative development, we should provide training of highly-qualified personnel in order to ensure national economy competitiveness.

Higher education development issues andtrends in advancement of education system in current conditions have been discussed by such scientists as V. Kremen, V. Kutsenko, I. Hryshchenko, M. Martyniuk.

Fundamental studies of higher education functioning can be found in materials of Ukrainian scientists: V. Andrushchenko, L. Antoshkina, T. Boholib, I. Vakhovych, I. Kaleniuk, O. Komarova, O. Kuklina, V. Kutsenko, O. Levchenko, E. Libanova, A. Muzychenko, L. Plakhotnikova, S. Semeniuk, N. Ushenko, L. Fedulova et al.

The purpose of research is current Ukrainian highereducation studying and determining the ways of its innovative development.

In the modern context one ofthe key factors for national economy competitiveness is the level of educational services market. For this reason, the task of providing proper functioning of the market is a prerequisite for Ukrainian economy development. This task is especially relevant today, for each employer should attract highly-qualified personnel to ensure the competitiveness of their companies' products on domestic and international markets.

Innovative policy should cover all higher education institution activities, be responsible for its development and competitive recovery. Innovative policy introduction into education system should be subject to well-defined principles ensuring the effectiveness of higher education institution innovative development in an increasingly autonomous and decentralizing management environment.

Ukrainian higher education institutions have the potential to become one of the most well-known European and world universities, as long as they acquire an innovative way of development. They should take into account their own experience

[217]Безус П. І. Проблеми управління вищими навчальними закладами в сучасних умовах / П. І. Безус // Вісник КНУТД. – Спец. випуск. – 2016. –199–204.

and the experience of national innovative systems formation in developing countries[218,219]. This is the only way to provide further improvement for domestic system of higher education institutions, while increasing its competitiveness and quality. The state education policy, which serves as the basis for choosing an innovative strategy for the development of Ukrainian higher education institutions[220], is meant to be directed at fulfilment of these targets.

Ukraine ranked above-average for a number of factors for educational services market innovative development in 2015–2016.

Ukraine, therefore, ranked 45th in terms of national higher education system efficiency in 2016[221]; according to the level of higher education development and scientific research – 31st and 45th respectively among 141 countries[222], and in terms of higher education and training – 34th position among 140 countries[223]. The top ten of the 65 higher education systems were the United States, Great Britain, Germany, Australia, Canada, France, the Netherlands, China, South Korea and Japan[223].

Also worth noting is that the level of population higher education coverage as compared to other countries of the world, Ukraine rates high. In 2008-2014 the rate was 79%[224]. One should mention that there traditionally was a high demand for educational services in Ukraine.

Despite recent decrease in demand associated with demography, events in Crimea, Donetsk and Luhansk regions, increasing opportunities for getting higher education abroad, this tradition has survived. In 2013 Ukraine ranked fourth for higher education advancement among the countries of Central and Eastern Europe, giving place to the USA, Israel and Canada.

There are state, public and private higher education institutions in Ukraine. In 2016, there were 288 higher education institutions of the third and fourth accreditation levels: state and public – 208, private ones – 80.

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[218]КасичА. О. Досвід формування національних інноваційних систем в країнах, щорозвиваються / А. О. Касич // Актуальні проблеми економіки. – 2013. – № 5 (143). – С. 46–49.

[219]Касич А. О. Conceptual provisions of development of Ukrainian national innovation system / А. О. Касич, М. Вохозка // Науковий вісник Полісся. – 2017.– № 2 (10), Ч. 2. – С. 16–23.

[220]КарзунІ. Г. Аналіз та оцінка розвитку освітніх послуг в Україні /Г. Карзун // Сучасні проблеми і перспективи економічної динаміки: матер. Всеукр. наук.-практ. конф. (м. Умань, 20 березня 2014 р.) / Економічній вісник: збірник наукових праць. Вип. 8. – Умань: ФОП ЖовтийО.О., 2014. – С. 36–43.

[221]QS Higher Education System Strength Rankings 2016. – Retrieved from: http://www.topuniversities.com/system-strength-rankings/2016.

[222]The Global Innovation Index 2015. – Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf.

[223]The Global Competitiveness Report 2012–2013. – Retrieved from: http://www.3.weforum.org/docs/WEF_GSR_Report_2012-12.pdf.

[224]Human Development Report 2015. – Retrieved from: http://hdr.undp.org/sites/default/files/2015_human_development_ report.pdf.

To be sure, over the past five years there have been changes in the number of higher education institutions. During 2011–2016 their number decreased from 330 to 288, representing almost 15%[225].

From our point of view, the main reasons for the reduction of higher education institutions of the third and fourth accreditation levels are the adoption of the Law of Ukraine "On higher education" (some education institutions do not meet its requirements), decrease in state orders, as well as applicants reduction. The reasons are described above.

In 2016 there were more than 1.5 million 605.3 students studying at higher education institutions of the third and fourth accreditation levels, among them:

- 45% for the budget funds;
- 5% for local budget;
- 50% for natural and legal entities funds.

The educational process is provided by more than 158 thousand academic and pedagogical staff at higher education institutions of the third and fourth accreditation levels.

One of the main problems is the lack of smart personnel training policy in Ukraine and, as a result, there is no interaction between the educational services market and the labour market. Nowadays, there is a demand for training in the field of "Law", "Management", "Finance", "Medicine", which does not meet the needs of labour market and significantly affects the shortage of highly-qualified personnel in key sectors of economy. An employer's point of view is that there is too much graduates with business/economic and legal education in labour market. It is clearly demonstrated by 57% and 55% of the surveyed employers, respectively. At the same time, 44% of respondents highlighted the lack of specialists in engineering education, IT specialists – 12%, and builders – 17%[226].

Similar problems also occur in foreign labour markets. So, in the early 80's there was a need for skilled engineers in many branches of British economy, and it was not satisfied. In the late 1990s, the demand for highly-qualified professionals exceeded supply and grew fast enough in the USA. In the middle of the first decade of the twenty-first century 44% of UK employers noted that they could lose their business due to the lack of qualified specialists[227]. Therefore, the question of strategic forecasting for specialists demand and adjusting the educational services market to

[225]ОсновніпоказникидіяльностівищихнавчальнихзакладівУкраїнинапочаток 2015/16 навчальногороку: стат. бюлетень. – К.: ДержавнаслужбастатистикиУкраїни, 2016. – 219 с.

[226]Досвід працевлаштування випускників вищих навчальних закладів: погляд випускниківта роботодавців [Електронний ресурс]. – Режим доступу: http://www.slideshare.net/bestuniverua/ss-27208268.

[227]Куклін О. В. Стратегічні пріоритети розвитку вищої освіти в концепції інноваційного розвитку України / О. В. Куклін // Формування ринкової економіки: зб. наук. праць. – Спец. випуск. Маркетингова освіта в Україні. – К.: ДВНЗ «КНЕУ ім. В. Гетьмана», 2011. – С. 99-108.

state order arises. The state order for personnel training should guarantee the training range at the expense of budget funds. For this purpose, it is necessary to form a mechanism for state monitoring in the need for personnel, to guarantee personnel training for knowledge-intensive and high-tech industries. At the same time, the problem of employers' associations representatives activation to forecast the need for specialists at the state level, to monitor labour market, to develop actively social partnership, which we consider as a system of relations between employees, employers, state authorities and local self-government. This system is referred to provide coordination between employees and employers interests in the matter of regulation in labour-management relations and other directly associated issues[228]. The problem of providing each graduate of a higher education institution with the first place of work deserves serious attention. At the beginning of 2013, 76% of graduates had a permanent job.

Specialists with higher education hold key positions as a part of Ukrainian economy.

At the beginning of 2014, employees with higher, basic and incomplete higher education accounted for almost 60% of the registered number of full-time employees in Ukrainian economy. According to some economic activities, employees with higher education were the predominant category of employees, in particular, in financial and insurance activities – almost 88%; public administration – 85%; science – 80%; information and telecommunication – 76%; museum and library activity – 75%; education – 73%[229].

Steady increase in education expenditures is determined by the complexity of curricula, the need to use the latest laboratories and training equipment, the involvement of highly-qualified teachers. Governments across the world can hardly provide funding for higher education. As a result, there is an urgent need to attract business funds. An employer investment in raising employees' professional competencies is an important component of business development, particularly given that employees' education affects positively business return level. Unfortunately, business expenses for vocational education in Ukraine are not always consistent with the tasks of socio-economic development[230].

There is a positive tendency in scientific staff training. In recent years, the number of postgraduate training programmes has increased by 4% and doctoral programmes by 15%. Accordingly, the number of those wishing to receive a certain degree has increased: postgraduate students – by 5%, doctoral students – by 39%.

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[228]Кочетова И. Д. Социальная ответственность как предпосылка социального партнерства / И. Д. Кочетова // Высшее образование сегодня. – 2009. – № 8. – С. 52–53.

[229]Праця України у 2013 році: Статистичний збірник. – К.: Державна служба статистики України, 2014. – 336 с.

[230]Карзун І. Г. Організаційно-економічні засади інноваційного розвитку системи закладів вищої освіти в Україні: дис. ... канд. екон. наук: 08.00.03 / Ірина Григорівна Карзун. – Кропивницький, 2016. – 270 с.

At the same time there is a misemployment of young specialists. All this reduces the economy competitiveness, leads to an increase in employers expenditures for employees' retraining.

Current legislative and regulatory framework, higher education institutions monitoring activity does not correspond to modern social relations as well. And this reduces the efficiency of personnel training and the possibility of innovative economic development.

Existing structural disparities between labour demand and labour supply limit considerably both employment opportunities for the unemployed and satisfaction of enterprises staffing needs. There is a tendency for an imbalance between the actual and the required levels of education and employees qualifications in Ukraine. The reason for such disproportions is the growth of requirements for employees on the part of employers in line with new organizational and technological changes in production, as well as the reduction of future specialists' educational level quality. In certain cases, there is lack of employers' interest in employees' professional development with insufficient qualifications due to significant expenses for these purposes[232].

Recent studies of the quantitative indexes of higher education in Ukraine revealed the following trends:

- decrease in the number of students over the last years;
- decrease in the number of people studying on a commercial basis;
- low percentage of graduates with job placement;
- increase in the number of Doctors of Science and PhDs among the teaching staff of a higher education institution at a relatively low salary;
- low rates of updating for material and technical facilities of a higher education institution;
- low cooperation level of a higher education institution with real state economy.

Ukrainian higher education system consequently does not contribute to the proper national economy innovative development.

Taking all the aforesaid intoconsideration, one can conclude that higher education institutions should respond properly to changes, taking place in society, focusing on the labour market. In some cases, they should form the market by themselves that involves significant changes in university structures activities, which should enable education institutions to provide more promising positions both nowadays and in the future.

The content of state innovative strategy is the creation of mechanisms for "science, business, and state partnership", which requires continuous supply of new upper level personnel offered by education system.

Within this framework, there is a need for task-oriented training of innovative type specialists. The ability of the system therefore to ensure its stable development in the context of permanent changes in macro-environment is an essential feature of its significant innovative capacity.

2.10. Kształtowanie intuicji u studentow dotyczacych łańcuchów Markowa poprzez zabawy zwiazane z symetryczna gra losowa

Łańcuchy Markowa stanowią jedno z najczęściej używanych narzędzi modelowania i symulacji rzeczywistych procesów losowych (por.[231, 232, 233, 234]), charakteryzujących się stałymi wartościami prawdopodobieństw przejść między poszczególnymi stanami.

Aczkolwiek formalna definicja łańcucha Markowa wymaga użycia pojęć rachunku prawdopodobieństwa (por. np.[247] oraz sekcję 2 niniejszej pracy), modelowane sytuacje mogą być bardzo proste i zdecydowanie przydatne do kształcenia intuicji związanych z charakterystycznymi własnościami rzeczywistych procesów losowych, poddających się analizie opartej o model Markowa.

W niniejszej pracy omówimy przypadek symetrycznej gry losowej, która stanowi, z jednej strony, jeden z najprostszych przykładów łańcucha Markowa, z drugiej zaś obszar pozyskiwania doświadczeń, znany absolutnej większości z nas.

Opis symetrycznej gry losowej zaczerpniemy z, ponad wiekowej, pozycji[235], konkretyzując zasady, modyfikując nieco oznaczenia i używając współczesnej terminologii.

> Gra symetryczna:
> Dwaj gracze, o kapitałach początkowych $K1$ i $K2$ monet, gdzie $K1, K2 > 0$, rzucają kostką symetryczną i w myśl zasady:
> *parzysta liczba oczek to wygrana pierwszego nieparzysta – drugiego*,
> przekazują sobie 1 monetę.
> Gra trwa do momentu, gdy jeden z graczy straci wszystkie monety.

Uwagę naszą skupimy na dwu kwestiach: prawdopodobieństwach wygranej poszczególnych graczy, oraz czasie trwania gry.

Nasze dalsze rozważania dotyczyć będą możliwości wykorzystania opisanej, gry jako narzędzia dydaktycznego, na trzech różnych poziomach wiekowych i kompetencyjnych:

- dzieci potrafiące liczyć do dziesięciu,

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[231] Feller W.: *Wstęp do rachunku prawdopodobieństwa*, PWN, Warszawa, 1977.
[232] Josifescu M.: Finite *Markov Processes and Their Applications*, John Wiley & Sons, New York, London 1988.
[233] Kubik L., Krupowicz A.: *Wprowadzenie do rachunku prawdopodobieństwa i jego zastosowań*, PWN, Warszawa, 1982.
[234] Lipski W.: *Kombinatoryka dla programistów*, WNT, Warszawa, 1985.
[235] Gosiewski Wł.: *Zasady rachunku prawdopodobieństwa*, E. Wende i S-ka, Warszawa, 1906.