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THE PROSPECTS OF VIRTUAL REALITY (VR) TECHNOLOGY IN EDUCATIONAL PROCESS AND BUSINESS

Urgency of the research. *Many educators and researchers believe that information technology could bring innovation to traditional educational instructions. The use of modern VR technology & games in education, science (experiments), economics, business is an urgent task in the context of rapid information development.*

Target setting. *Many young management professionals who graduated from the university and lacked sufficient practical experience, as a result did not develop the necessary skills. The indicated generates lower level quality specialists, who are not able to make managerial decisions and solve problem issues.*

Actual scientific researches and issues analysis. *The usage of virtual reality in various spheres of national life was studied by A. V. Goshchinsky, A. O. Petrenko-Lysak and others. The main problems concerning virtual technologies in the system of higher education are outlined in the works of A. A. Zasekin, Yu. S. Lemeshko and others.*

Uninvestigated parts of general matters defining. *The scientific works do not pay much attention to the issue of the impact on the formation of practical skills through virtual technologies in students of management specialties.*

The research objective. *Getting the necessary practical skills of working with information is possible only if the student is actively involved in a variety of training sessions and games which are as close as humanly possible to the realities of the modern business environments.*

The statement of basic materials. *In this article we define different concepts such as simulation, virtual reality and technology, virtual worlds and environments that can be actively applied in practice. The article also explores the role of simulation in education, business; history & advantages of VR technology.*

Conclusions. *Business simulations are considered to be a progressive trend in modern education, that is capable of forming practical skills in the virtual reality as close as possible to modern transformational conditions. The usage of such cutting-edge technologies will allow to create practical experience of the highest quality in future managers.*

Keywords: *VR technology; business; education; simulation in education.*

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ПЕРСПЕКТИВИ ВИКОРИСТАННЯ ВІРТУАЛЬНИХ ТЕХНОЛОГІЙ У НАВЧАЛЬНОМУ ПРОЦЕСІ ТА ПРАКТИЧНІЙ ДІЯЛЬНОСТІ

Актуальність теми дослідження. *Багато педагогів і дослідників вважають, що інформаційні технології можуть принести інновації традиційним освітнім процесам. Використання сучасних технологій VR та ігор в освіті, науці (експериментах), економіці, бізнесі є актуальним завданням в умовах стрімкого інформаційного розвитку.*

Постановка проблеми. *Багато молодих фахівців у сфері менеджменту, які закінчили університет та не мали достатнього практичного досвіду, як результат не сформували необхідних навичок. Зазначене породжує низький рівень якості фахівців, які не здатні приймати управлінські рішення та розв'язувати проблемні питання.*

Аналіз останніх досліджень і публікацій. *Використання віртуальної реальності в різних сферах національної життєдіяльності вивчали А. В. Гощинський, А. О. Петренко-Лисак та ін. Основні проблеми відносно віртуальних технологій в системі вищої освіти окреслені в роботах А. А. Засєкін, Ю. С. Лемешко та ін.*

Виділення недосліджених частин загальної проблеми. *У наукових працях зовсім не приділяється увага питанню відносно впливу на формування практичних навичок за допомогою віртуальних технологій у студентів управлінських спеціальностей.*

Постановка завдання. *Отримання необхідних практичних навичок роботи з інформацією можливе лише за умови активного залучення студента до різноманітних навчальних занять та ігор, які максимально наближені до реалій сучасного бізнес-середовища.*

Виклад основного матеріалу. *У цій статті ми визначаємо різні концепції, такі як моделювання, віртуальна реальність і технології, віртуальні світи та середовища, які можна активно застосовувати на практиці. В статті також досліджено роль моделювання в освіті, бізнесі; історію та переваги технології VR.*

Висновки. *Бізнес-симуляції вважаються прогресивною тенденцією в сучасній освіті, яка здатна максимально наблизити практичні навички у віртуальній реальності до сучасних трансформаційних умов. Використання таких новітніх технологій дозволить формувати у майбутніх менеджерів практичні навички найвищої якості.*

Ключові слова: *технологія VR; бізнес; освіта; моделювання в освіті.*

Urgency of the research. In the educational process of higher education the information systems that use computer technology play a very important role, since full involvement in the student's learn-

ing process increases motivation and success in obtaining knowledge, forms the necessary skills for further practical activities. One of the perspective educational methods of modern information technology offers a new educational environment - virtual reality (VR). In recent years, such technologies are widely used in developed countries, but, unfortunately, they have not been sufficiently distributed in domestic higher education institutions.

Target setting. The vast majority of young professionals who have graduated from the university have not had sufficient practical experience, and most employers, complain about lack of practical training and abilities low specialists quality and, consequently, unwillingness to effectively solve problems that occur in organization or company. This indicates that students most of the time have only theoretical skills and are not able to solve practical tasks.

Actual scientific researches and issues analysis. Presented both foreign and domestic studies (Yu. Trach, V. Klymniuk, V.Berezovsky, N. Foreman, etc.) substantially enrich the theory of the use of virtual reality in higher education, but the works do not adequately cover the issues of the impact of the introduction of virtual technologies on the future practical activity of students in the field of managerial work. Foreign developments in the usage of gains of virtual technology are widespread in higher education institutions, and the study of their impact on efficiency has been proven by a large number of publications (Chen G., Huang X., Dong J., Zhai H., Wang J., etc.).

Uninvestigated parts of general matters defining. To date, the link between the introduction of virtual technologies into the training of students in the field of management and their subsequent use is not investigated. Objective is that these technologies are able to improve motivation for learning, but there is no mention in the works of the possibility of their further use in the practice of enterprises and organizations where graduates of higher educational institutions will work.

The research objective. Today, virtual reality technologies have become more accessible and active use of them, which allows to bring the learning to the realities of the modern business environment as much as possible, will allow to obtain not only the necessary practical skills of the manager, but also will promote the spread of their use in management practice. Therefore, in the article, based on the generalization of the accumulated experience in studying the possibilities of using VR technologies in theory and practice, we will define their role and place in the educational process.

The statement of basic materials. It is advisable to review in the following order: 1) The history & advantages of VR technology; 2) The role of simulation in education. Business simulations.

1. The history & advantages of VR technology.

Virtual reality (VR) is an interactive computer-generated experience taking place within a simulated environment, that incorporates auditory, visual, haptic, and other types of sensory feedback. This immersive environment can be similar to the real world or it can be fantastical, creating an experience that is not possible in ordinary physical reality [1]. Let us overview long history of Virtual Reality (Tab. 1).

Table 1

The history of Virtual Reality*

The XIX century The history of virtual reality dates back to the 19th century	
1838	The starting point is considered the invention stereoscope in 1838. Sir Charles Wheatstone used brain abilities to view a stereoscopic pair of separate images, depicting left-eye and right-eye views of the same scene, as a single three-dimensional image.
The XX century The 20th century can be divided into four intervals	
I period (1950)	
1929	During this period a significant event was a creation in 1929 of the first simulated flight simulator "Blue Box" or "Link Trainer" Edwin Link. Simulator looked like a copy of the fuselage and motor control to help pilots simulate aircraft and create training.
II period (1950-1970)	
1950	In 1950 VR devices started getting a more simple shape which is common today. The first model of the display head (HDMs) appeared in 1950-60.

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Continuation of Table 1

1960	In 1960 Morton Leonard Heilig patented Telesphere Mask. And in 1962 produced the first prototype machine "Sensorama" that was able to display stereoscopic 3-D images in a wide-angle view, provide body tilting, supply stereo sound, and also had tracks for wind and aromas to be triggered during the film.
1968	In 1968 Ivan Edward Sutherland with the help of his student Bob Sproull, he created the often miscredited second virtual reality and augmented reality head-mounted display system, named The Sword of Damocles, which also was the first HMD with motion tracking and computer connection (was the basis for tracking the movement of HMD).
III period (1970-1990) At this time the first VR worlds & applications were introduced in video games	
1978	In 1978, an MIT team working with Andrew Lippman developed the Aspen Movie Map - an earlier hypermedia system which allowed users to make a virtual tour through Aspen, Colorado.
1984	In 1984 Jaron Lanier (who is often regarded as the person who coined the term virtual reality) founded VPL Research - one of the first companies that developed and sold virtual reality products such as Data Glove, EyePhone and Audio Sphere.
IV period (1990-2000) Towards the twentieth-century virtual reality technology starts to be more accessible to the public	
1991	In 1991 Sega released the Sega VR headset for use in arcade games and HMD LCD screens, stereo headphones, with a simple inertial sensor for a primitive version of head tracking.
1995	In 1995 Nintendo released Virtual Boy - a first portable game capable of displaying stereoscopic 3D graphics.
The beginning of the XXI century The XXI century brought a revolution in hardware and software VR technologies, giving developers tools to create realistic VR worlds	
2007	In 2007, Google launched an application Street View which realistically represents maps worldwide, and in 2010 connected a stereoscopic 3D-mode.
2010	In 2010 Luckey Palmer presented the first prototype Oculus Rift, capable of 3D audio effect, rotational and positional tracking, a 90-degree field of view, which was revolutionary at the time.
2014	In March 2014, Facebook CEO Mark Zuckerberg acquired Oculus VR for US$2.3 billion in cash and stock.
2014	In 2014 Google developed Google Cardboard a VR platform for use with a head mount for a smartphone. Named for its fold-out cardboard viewer, the platform is intended as a low-cost system to encourage interest and development in VR applications.
2014	In 2014 Tokyo-based startup announced FOVE is the first virtual reality headset that utilizes eye tracking.
2015	In 2015 HTC and Valve Corporation developed a virtual reality headset the HTC Vive that uses "room scale" tracking technology, allowing the user to move in 3D space and use motion-tracked handheld controllers to interact with the environment.
2016	In 2016 Sony Interactive Entertainment released Project Morpheus, The PlayStation VR system for PlayStation 4.

*built by authors on the basis of [2]

Growth of virtual reality (VR) technology continues at a rapid pace and its ability to create real-world experience finds its application in education & training.

There are various ways in which we can use VR technology. Let us look at several reasons why VR training is better than traditional learning practices [3]:

- Little, to no risk.
- Safe, controlled area.
- Realistic scenarios.
- Can be done remotely saving time and money.
- Improves retention and recall.
- Simplifies complex problems/situations.
- Suitable for different learning styles.

❖ Innovative and enjoyable.

"In a study carried out by the National Training Laboratory, retention rates for lecture-style learning were at 5%, and reading rates were at 10%, while VR had a retention rate of 75%". – MASIE Report 2017.

The effectiveness of practical learning over "dry" theories has been demonstrated throughout the recent years. Most of the time its faster & better learn horse riding by actually riding a horse rather than watching thousands of videos or reading about it.

2. The role of simulation in education. Business simulations.

Teachers and technologists are searching for new and innovative ways to design learner-centered learning environments effectively, trying to engage learners more in the learning process. Claims have been made that online games have the potential to teach, train and educate and they are effective means for learning skills and attitudes that are not so easy to learn by rote memorization [4].

There has been a lot of research done in identifying the learning effectiveness in game-based learning. Learner characteristics and cognitive learning outcomes have been identified as the key factors in research on the implementation of games in educational settings.

Simulation is the imitation of the operation of a real-world process or system [5].

The business simulation is simulation used for business training, education or analysis.

Most business simulations are used for business acumen training and development. Learning objectives include strategic thinking, decision making, problem-solving, financial analysis, market analysis, operations, teamwork, and leadership [5]. The word simulation is sometimes considered too mechanistic for educational.

The possibility to experiment with variables which can be manipulated is particularly useful in management research because moral and physical factors often prohibit experimenting with real people, systems, and organizations [6]. Let us take a glance look at the history of business simulations (Fig. 1, Tab. 2).

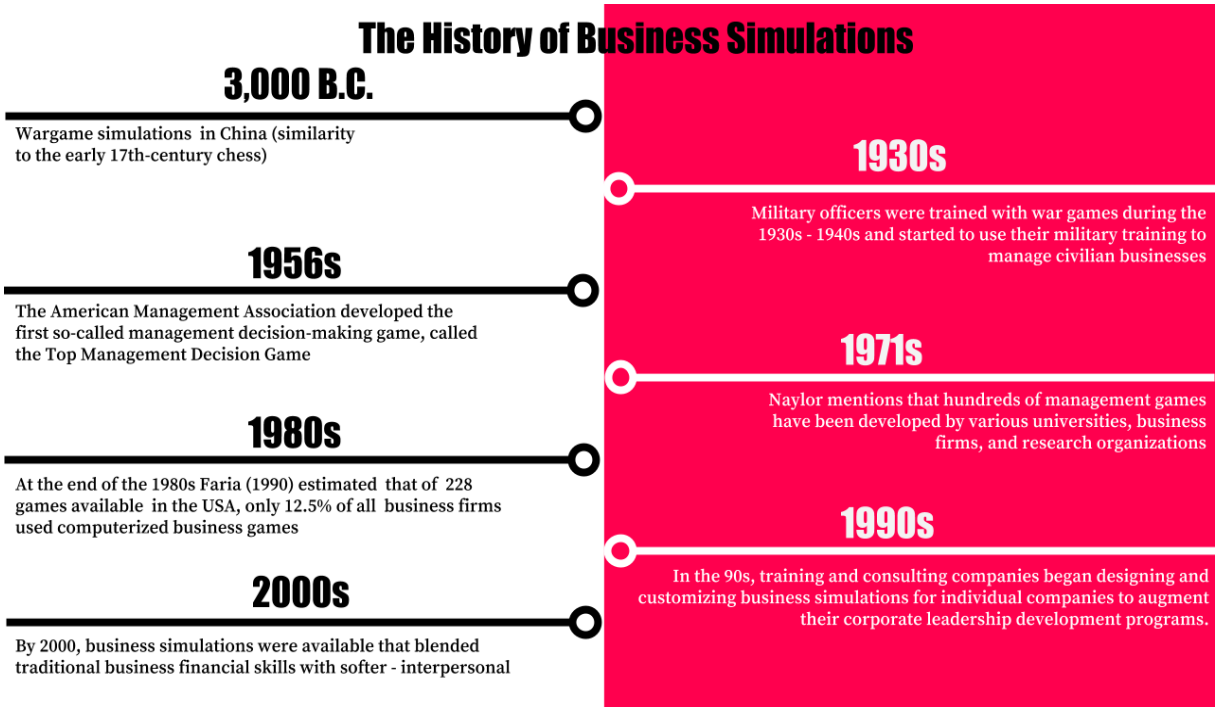

Fig. 1. The history of business simulators*

*built by authors on the basis of [5; 7]

Table 2

Business Simulation Software & Games*

Name	Date(s)	Genre(s)	Overview
SimCity	1989	Construction and management simulation, city-building	SimCity game series is an open-ended city-building sandbox, the main goal of the player is to create and develop a virtual city, industrial and commercial sectors, raise living standards, fight diseases and crime, create recreational zones, fight traffic jams, crises, etc.
Transport Tycoon	1994	Business simulation game	Real-time economic strategy, in which player acts as a manager of the transport company and tries to get the maximum profit by transporting passengers and various cargoes by roads, railways, monorail roads, as well as by water and air transport.
Capitalism	1995	Business simulation	A player needs to produce and sell their goods, managing their resources and materials. The game also develops necessary skills to maintain the optimal balance of supply and demand in order to maximize profit. So, an inexperienced novice who irrationally distributes his resources has quite a lot of chances either to burn out or be deceived by more entrepreneurial businessmen.
Anno	1998	Business simulation, city-building	Anno is a real-time strategy video game series with business simulation and city building elements dedicated to the creation of both small colonies and majestic empires. The main task of the player is to set a foot on the island and start construction of his own colony, rationally using available resources and effectively managing finances in his possessions.
Europa Universalis	2000	Grand strategy	The main goal is to do everything that contributes to the prosperity of the player's possessions, to keep under control all economic processes within the country, and also to try to expand the territory of its power while maintaining friendly diplomatic relations with other empires.

*built by authors on the basis of [8-12]

The poor quality of teaching and training of business managers, especially in the third world and developing countries, is one of the main reasons for low or in-efficient businesses. In many countries, due to various reasons like a shortage, budget, poor quality of education, university professors & teachers have no other choice left, except to mostly teach theoretical bases to their students.

This has caused the students not to practically be familiar or understand the concepts, which is followed by the downgrading of the quality of education and no job success of the students. One of the major advantages of VR & business simulations is the opportunity for a user to experience the business environment, before even taking any step into the real business environment [13].

Since major of young people are in virtual reality most of their time, it can be used for professional growth. Unlike traditional teaching methods, the use of computer business games greatly reduces the time for the accumulation of professional experience and provides a real opportunity to analyze the impact of the management decisions done on the health of organization or company.

The business simulators allow participants to take part in different situations and develop alternative strategies for solving complex industrial and economic problems using scientifically-based and intuitive methods, in particular, the method of "attempts and errors", to justify or check their hypothesis, goals, objectives, theories etc.

Business practices may be hard to accomplish in set time defined by default curriculum. Since management decisions are made in stages, it easier to analyze the results and mistakes being made, their effectiveness. Thus, making it easier for students to understand the complexity of economic systems and develop skills & abilities to handle future real-life economical situations etc.

Implementation of effective risk management in organizations allows to identify and analyze various types of risks that arise throughout the life cycle for further risk reduction or elimination and provides managers with the necessary information.

Implementing appropriate solutions, managers are able to effectively solve financial problems which are generated by various types of risks. The following may guarantee a stable and continuous development of organizations. depending on many factors, both objective and subjective, most organizations do not have the capability to implement a modern risk management system which would allow them to find the loopholes in their security.

By building a risk management system using virtual reality technology (VR) one can improve the ability and time it takes for any organization to react to dangerous (risky) situations under uncertainty. This can play a decisive role in life and development of organizations in an ever-changing world (environment, market), which further confirms the relevance of the studied issue.

VR technology is the computer-generated scenario, represented by a simulation system in which a one can perceive and interact with the virtual world through a constructed 3d environment.

Throughout the prolonged period (since 1960), VR technology has gained the following characteristics:

1. Multi-sensory. With VR technology, one can perceive things through vision, motion, touch, hearing and even higher smell and taste [14].
2. Presence. Presence means that we can experience the authenticity of a virtual 3d environment within the VR system, a higher-level of VR technology enables us to have more immersive experience.
3. Interaction. Implies the extent to which one can interact and operate with objects within the virtual environment.
4. Autonomy. Implies the extent of motion of the object according to it physical and chemical definitions in the real world within the virtual environment [15].

As of today, the world's leading information technology corporations are developing their own VR technologies. The use of VR technology is described in many areas: medicine, entertainment, design, military, industry, construction, education, etc. It should be also noted that the use of these technologies at public administration and local government levels may also improve the efficiency & quality of their work.

Potential of VR in Human Resources.

Talent and competence of human resources in organizations are key elements which promote their development, that's why recruitment and training of staff is a key task of effective (human resource) management. This is relevant not only for Ukrainian enterprises but also for the world's largest companies. In the history of organizations, there are many examples where the incompetence of employees led to a decrease in the efficiency, which afterward gave rise (birth) to the corresponding types of risks.

In order to avoid these problematic issues, it is essential to combine traditional staff training with VR technology, allowing, on one hand, to test professional capabilities of employees through the creation of a virtual environment, and on the other hand, to expand workplace collaboration and improve training effect. In addition, human resource department may create actual cases in the VR environment for trained employees to solve problems with their own professional capabilities and skills & to see what to expect of employees at every stage in their career [16]. We note that these technologies are seen (reflected) in the leading companies of the world, but have not been widely used yet in Ukraine.

Effective Manufacturing Planning and Control System.

As you know, the larger organization, the larger its structure, and content of tasks performed by employees, thus risk situations occur more often.

VR technologies allow users to have much more precise control at all stages of production activity of enterprises, thus allowing to realize possible optimizations and budget. In production process management, the production line can be transformed into a 3D-spatial image with VR technology and carry out the management of the production line in the virtual space. Management of key sections (human resources, material resources, equipment) can be more visualized, resulting in a more effective management and also to reduce corresponding risks [17].

Advance in the risk management optimization.

Company optimization involves: the reformation of production, promoting steady and sustainable development effectively, and as a result bringing the prospect of wider development. VR technology allows us to solve various optimization tasks that can be brought into the virtual space, which further allows us to improve the efficiency of the scientific and systemic nature of organization optimization. Traditionally,

optimization includes some content, for example, in a construction project or business, the use of a new production line, etc. All this contributes to the sustainable development of organizations [18].

Clear valuation of possible outcomes.

The appropriate decisions making with the help of VR technology can provide outcomes & results of impacts in a more rendered way managers have only ever dreamed of, thus increasing the speed of examination of proposals and use additional information to reduce the degree of uncertainty in different situations, as a result implementing new level of effective risk- management.

While not reducing the importance of theoretical training of students in different disciplines and forms of studying, it should be noted that the problem of insufficient practical knowledge & skills of graduates of universities and institutes is not new for Ukrainian employers. Especially with regard to managerial specialties, due to problems with the practical experience in enterprises and organizations. As a rule, it is only limited to a brief excursion on their work. This problem is associated with many objective and subjective factors (short-term practice, size of enterprises and organizations, etc.). The Fig. 2 below illustrates implementation of VR technology in the system of education process.

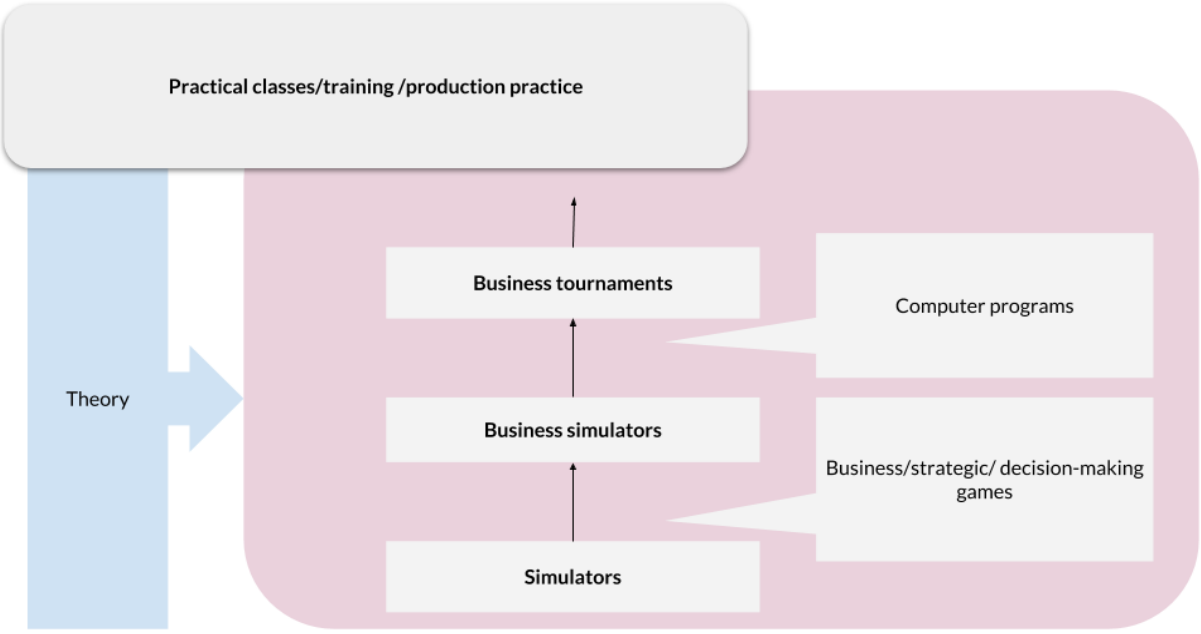

Fig. 2. Place of VR technology in system of education process

As a result, graduates are not ready for effective management of organizations in the modern real-life environment. The results of testing the Master's in "Management", "Change Management", "Risk Management", "Management of enterprises in the manufacturing sector", "Communication process in local self-government" testify the possession of theoretical skills while demonstrating complete gaps in practical skills.

The elimination of this problem should begin with the active involvement in a variety of training that is close to the real environment in which the national business structures of different types operate. It should also be noted that the students of a discipline such as "Public Management" generally have no opportunity to practice in institutions adapted to modern realities since in Ukraine the process of reforming state structures is still not completed and tested. So the relevance of this issue for future public officials is of great importance.

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At the same time, the learning process in universities and institutes should be both useful and interesting, therefore, we believe that learning with the help of "games & simulators" can solve this problem because the method is active with the possibility of attracting a wide range of listeners. This method is not new, but any simulator needs to be adapted to the corresponding specialty. There are not many studies in Ukraine on this subject, and most of them concern only economic areas (also used mostly in foreign development). Surveys among Master's & students specializing in "Management" indicate interest in implementing the methods described above in the learning process.

It is important to offer such a "game" that would be useful in the future practical activities of graduates. It is important to create such a virtual environment (playfield) in which players (listeners) have the opportunity during the training & learning to create or manage a commercial or non-commercial structure. Such games & simulations will allow both the methods for efficient management of various institutions through the implementation of management functions and significantly reduce the time to work out practical skills in various fields (while having the right to make mistakes).

Conclusions. Students are not satisfied with the situation when the material is presented as a "dry" theory. As a result of such training, it is often unclear how and where this knowledge will be applied.

Even if the student is in compliance with all requirements, this does not guarantee his full immersion in decision making (taking into account the levels of complexity) which is very important for graduates of the managerial disciplines.

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