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## COMPARATIVE ANALYSIS OF PROGRAM SUBJECT AREAS FOR TRAINING INFORMATION TECHNOLOGY MANAGERS IN UKRAINE AND THE UNITED STATES

**Abstract.** *The article presents a comparative analysis of information technology and management subject areas in Ukraine and the US over the past 25 years. Special attention is given to the program subject areas under which universities can train specialists in IT management, a branch at the intersection of IT and management. In particular, the article traces transformations in the Cabinet of Ministers' decrees on these fields of study, and details the amendments introduced into the classification of qualification levels, fields of study and subject areas in compliance with Decrees № 325 dated 1994, № 507 dated 1997, № 1719 dated 13.12.2006, № 787 dated 27.08.2010, and № 266 dated 2015. The article also outlines the higher education standards on IT and management developed on the basis of active Decree № 266 and other regulations. Further, it identifies the specifics of professional training of managers and IT specialists in the US. In particular, it outlines the Guiding Principles and Standards for Business Accreditation by the Association to Advance Collegiate Schools of Business, and the Computing Curricula Guidelines jointly developed by the Association for Computing Machinery and the Computer Society of the Institute for Electrical and Electronic Engineers. Finally, the article correlates computing-related study areas in Ukraine and the US, and shows that reforms in IT and management fields of study are still in progress in Ukraine. The author concludes that while IT components in management subject areas are quite comparable in Ukraine and the US, the weight of business ones in IT subject areas is much smaller in Ukraine, which sidelines the professional training of IT managers in these subject areas. The author stresses the prospects of further analysis of the IT management programs available in Ukraine as well as the opportunities of incorporating the US experience to develop professional training of IT managers in the universities of Ukraine.*

**Key words:** *program subject area; field of study; higher education standards; information technology; management; IT managers.*

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## **ПОРІВНЯЛЬНИЙ АНАЛІЗ СПЕЦІАЛЬНОСТЕЙ ДЛЯ ПІДГОТОВКИ МЕНЕДЖЕРІВ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ В УКРАЇНІ ТА США**

**Анотація.** В оглядовій статті представлено порівняльний аналіз спеціальностей для підготовки фахівців у сферах інформаційних технологій і менеджменту в Україні та США за останні 25 років. Особливу увагу приділено спеціальностям, у межах яких може здійснюватися професійна підготовка фахівців з ІТ-менеджменту як напряму на перетині інформаційних технологій та менеджменту. Зокрема, простежено трансформації у постановах Кабінету міністрів України стосовно цих галузей знань, детально розглянуто зміни, внесені у розподілення освітньо-кваліфікаційних рівнів, виокремлення галузей знань, напрямів підготовки та спеціальностей постановами № 325 від 1994 р., № 507 від 1997 р., № 1719 від 13.12.2006 р., № 787 від 27.08.2010 р. та № 266 від 2015 р. Окреслено стандарти вищої освіти у сферах інформаційних технологій і менеджменту, розроблені на основі чинної постанови № 266 від 2015 р. та інших нормативних документів. Визначено особливості регулювання професійної підготовки менеджерів та ІТ-фахівців у США. Зокрема, розглянуто Керівні принципи та стандарти з акредитації, розроблені Асоціацією з розвитку університетських бізнес-шкіл, та рекомендації Computing Curricula, розроблені Асоціацією обчислювальної техніки та Комп'ютерним товариством Інституту інженерів з електроніки та електротехніки. Співвіднесено комп'ютерні спеціальності в США та Україні. Встановлено, що в Україні продовжується реформування та розвиток галузей знань «Менеджмент» та «Інформаційні технології». Зроблено висновок, що передбачена стандартами ІТ-складова у підготовці менеджерів в Україні та США є подібною, а бізнес-складова в підготовці ІТ-фахівців в Україні значно менша, що звужує можливості підготовки ІТ-менеджерів в Україні в межах існуючих ІТ-спеціальностей. Підкреслено перспективність дослідження програм, за якими здійснюється підготовка майбутніх ІТ-менеджерів в Україні, а також важливість урахування конструктивного досвіду США для розвитку підготовки фахівців з ІТ-менеджменту в університетах України.

**Ключові слова:** спеціальність; галузь знань; стандарти вищої освіти; інформаційні технології; менеджмент; ІТ-менеджери.

**Introduction.** Information technology (IT) has deeply influenced progress in business over the past decades. To be competitive, companies and

organizations have to manage their IT effectively, and this has become a task of IT managers – specialists in the quite new area at the intersection of IT and management. In their companies, IT managers establish effective strategic and operational IT governance, manage emerging technologies, ensure effective communications between IT and other departments, develop IT investment plans, measure and assess IT contribution to the business, improve IT management processes, develop IT staff, etc. IT managers are in ever-growing demand in the global labor market. At that, education programs targeting this subject area are still few in Ukraine. As a result, future IT managers are mostly trained under either IT or management programs in our country. By contrast, US universities offer quite numerous IT management programs, both independent ones and embedded in either IT or business programs. In this light, to compare program subject areas covered by the universities of the US and Ukraine in the fields of IT and management may prove beneficial for development of future IT managers' professional training in Ukraine.

**Analysis of recent research and publications.** Professional training of both IT specialists and managers has received wide coverage from Ukrainian and international researchers over the past decades. In particular, N. Bezliudna and N. Dudnik addressed the issues of future managers' professional competence development; M. Horbunov and O. Yatsenko focused on training management students as leaders; I. Hinsirovska and O. Kapitanets' studies dealt with training of future managers in technical higher educational institutions. Harvard professors S. Datar, D. Garvin, and P. Cullen provided a detailed analysis of current curricula and emerging trends in graduate business education; L. Engwall and V. Zamagni outlined US management education in historical perspective; U. Lucas and P. Milford described key aspects of teaching and learning in accounting, business and management. In the IT and computing field, T. Kovaliuk, O. Yefimenko, T. Morozova, etc. analyzed various aspects of classification of program subject areas. International scholars addressed specifics of professional training of future specialists in information and communication technology (A. Jones, B. von Konsky, J. Mariga, C. Miller), information systems (H. Longenecker, D. Feinstein, J. Clark), information systems and technology (G. Lowry, L. Turner). However, professional training of IT managers has received little attention and there are still few papers dealing with this subject directly.

**The aim of this study** is to compare program subject areas in the fields of the information technology and management in US and Ukraine, with the focus on the programs combining the components of these two subject areas.

**Results of the study.** Over the past 25 years the government of Ukraine has several times amended and revised the names of program subject areas in the fields of IT and management, which illustrates the dynamic development of these fields and continuous reforming of the national education system. The 4 key Cabinet's Decrees regulating the fields since 1994 are as

follows:

1) Decree № 325 dated 18.05.1994. Under this document, there were 10 subject areas at the qualification level «specialist» (including Information Systems in Management) and 8 ones at the qualification level «junior specialist» within the field of study «6.0502 Management». Computing fields of study «6.0804 Computer Science» and «6.0915 Computer Engineering» covered 12 program subject areas for specialists and 11 ones for junior specialists.

2) Decree № 507 dated 24.05.1997. Having repealed the previous regulation, it introduced 4 education and qualification levels. According to this Decree, the field of study «0502 Management» included 3 program subject areas for junior specialists, 4 ones for bachelors, 5 for specialists and 5 for masters. Computing fields of study («0804 Computer Science» and «0915 Computer Engineering») offered 10 subject areas. There were 3 more computing subject areas within other fields of study. Besides, a new field of study («1601 Information Security») was introduced in 1997.

3) Decree № 1719 dated 13.12.2006 (referred to bachelors) and Decree № 787 dated 27.08.2010 (referred to specialists and masters). These regulations placed management in the field of study «0306 Management and Administering». There were 7 subject areas for specialists and masters, and 1 for bachelors. As of computing, bachelors and specialists/masters were trained in 9 and 25 fields of study respectively within 3 fields of study («0403 System Sciences and Cybernetics», «0501 Computer Science and Computer Engineering», and «1701 Information Security»).

4) Active Decree № 266 dated 29.04.2015 (and amended on 11.02.2017) placed the subject area «073 Management» into the field of study «07 Management and Administering» for all education and qualification levels. The updated field of study «12 Information Technology» covers 6 program subject areas («Software Engineering», «Computer Science», «Computer Engineering», «Systems Analysis», «Cybersecurity», «Information Systems and Technology»).

As seen from the described transformations, the Cabinet's Decrees altered not only qualification levels and the coding system of study fields but also the classification of the fields of study and program subject areas. In particular, the latter were significantly expanded and unified both in the fields of management and IT.

Based on the Laws of Ukraine «On Education» and «On Higher Education», the National Occupational Classification, the National Qualifications Framework, and the above mentioned Cabinet's Decree №266, the Standards of Higher Education of Ukraine were developed for masters and bachelors in the field of study «073 Management», and for bachelors in the field of study «12 Information Technology». The Standards were put in force in 2018-2019 (Approved Standards of Higher Education, 2017-2019).

Moving on to the documents that regulate the professional training of

IT specialists and managers in the US, we should note that the US higher education system is autonomous, multilevel and diversified. The country has no unified standards on business administration programs under which managers, including IT managers, are trained. At that, universities need to have their programs accredited. Accreditation standards and guidelines are developed and continuously updated by professional organizations and associations. In the US, the oldest and most respected organization that provides accreditation to business schools is the Association to Advance Collegiate Schools of Business (AACSB) founded in 1916. The mission of the AACSB is to define guiding principles and standards of business education, coordinate peer review and consultation, and recognize high-quality business schools that meet the standards and actively engage in the process. In July 2020, the AACSB completed updating its 2013 Guiding Principles and Standards for Business Accreditation. The 2020 Guiding Principles are organized into nine standards split into three categories: strategic management and innovation; learner success; and thought leadership, engagement, and societal impact. The transition period for adopting the 2020 business accreditation standards will take place between January 2021 and June 2023. The initial pilot occurred in the 2020/21 academic year (AACSB, 2020, p. 7-10).

Competing business accreditation bodies are the Association of Collegiate Business Schools and Programs (ACBSP) founded in 1988, and International Assembly of Collegiate Business Education (IACBE) founded in 1998. In the face of competition, the AACSB adopted a mission-based approach in 1994, under which primarily teaching institutions would be able to set their goals and demonstrate their achievement with less research emphasis (Hunt, 2015, p. 24). The curricula thematic elements valued by the AACSB include soft skills, IT, globalization, and corporate social responsibility.

In the IT and computing segment, US tertiary institutions are mostly guided by the Computing Curricula Guidelines developed jointly by the Association for Computing Machinery (ACM) and the Computer Society of the Institute for Electrical and Electronic Engineers (IEEE-CS) since the 1980s. In 1991, they provided their first guidelines for four-year Bachelor's degree programs in computer science and computer engineering (CC'91). Currently the Curricula cover the growing family of computing-related disciplines, including separate volumes for Computer Science, Information Systems, Computer Engineering, Software Engineering, Information Technology, and Cybersecurity (ACM, IEEE-CS, 2006, p. 1).

It is important to note that the IT subject areas defined by Ukraine's active regulations are harmonized with the Computing Curricula. In particular, four of six program subject areas are in complete accord, the subject area «Information Systems and Technology» combines two ones from the Computing Curricula (Information Systems and Information Technology). The area «Systems Analysis», which is singled out in Ukraine, is a component of both Information Technology and Information Systems areas in the US (table 1).

Table 1

Comparison of computing-related subject areas in Ukraine and the US

Cabinet's Decree №266 dated 29.04.2015	Computing Curricula Guidelines
121 Software Engineering	Software Engineering
122 Computer Science	Computer Science
123 Computer Engineering	Computer Engineering
124 Systems Analysis	-
125 Cybersecurity	Cybersecurity
126 Information Systems and Technology	Information Systems, Information Technology

Sources: Decree by the Cabinet of Ministers of Ukraine № 266 of 29.04.2015; ACM, IEEE-CS, 2006.

The IT education overview the Computing Curricula 2005 Report presents (ACM, IEEE-CS, 2006, p. 9-12) illustrates shifts in the focus of computing subject areas in the US. Undergraduate degree programs in computing-related disciplines began to emerge in the 1960s. Originally, there were 3 kinds of computing-related programs – Computer Science, Electrical Engineering, and Information Systems. Computer Engineering emerged from Electrical Engineering at the end of 1970s and developed into an independent subject area in the 1990. Information Technology programs began to emerge in the late 1990s too. Over the past 30 years, the focus of Electric Engineering and Computer Science has remained almost unchanged (hardware and software respectively), the subject area of Computer Engineering has expanded, and the subject area of Information Systems, which is of particular interest to our study, has shifted its focus to some extent (Table 2).

Table 2

Focus of computing-related subject areas in the US

Subject area	Focus	
	pre-1990s	post-1990s
Electric Engineering	Hardware	Hardware
Computer Science	Software	Software
Computer Engineering	Hardware	Hardware, software
Software Engineering	-	Software
Information Systems	Business	Organizational needs
Information Technology	-	Organizational needs

Source: ACM, IEEE-CS, 2006.

As a field of academic study, Information Systems began in the 1960s. Prior to the 1990s, Information Systems programs focused on training the specialists able to solve computing tasks for the business world: develop and maintain accounting systems, payroll systems, inventory systems, etc. By the end of the 1990s, networked personal computers became integral parts of the work environment, and the challenges of making proper use of information and technology to support organizational efficiency and effectiveness became crucial issues. It is important to note that the field of Information Systems exists under a variety of different names that reflect its historical development and different ideas about how to characterize it. The names of computer-related majors offered in US undergraduate institutions are most often represented by such terms as Management Information Systems, Information Systems and Computer Information Systems, as well as Information Management, Information Technology Management, Information Resources Management, Information Technology Resources Management, etc. (ACM, AIS, 2010, p. 12-13).

In the context of our study, the key difference between the program subject areas «Information Systems and Technology» in Ukraine and «Information Systems» and «Information Technology» in the US is that the latter assign a greater part to business components. They also directly address the sphere of IT management. In particular, one of the learning objectives of the core courses in the category «IS Strategy, Management & Acquisition» is to ensure that students understand the various functions and activities within the information systems area, including the role of IT management and the Chief Information Officer, and structuring of information systems management in companies (ACM, AIS, 2010, p. 54). In their turn, the guidelines on development of Information Technology curricula place the area «IT governance and resource management» among essential IT domains (ACM, IEEE-CS, 2017, p. 50).

Unlike business components, the weight of which is markedly different in the US and Ukraine's computing-related subject areas, IT components in management subject areas are quite comparable in Ukraine and the US. In particular, the basic competences expected from management graduates at both master and bachelor's levels include information and communication technology skills (Approved Standards of Higher Education, 2017-2019). The AACSB Guiding Principles read that «current and emerging technology should be appropriately infused throughout each degree program as appropriate for that degree and level of program» (AACSB, 2020, p. 39).

**Conclusions and prospects for further research.** To balance the qualitative and quantitative parameters of professional training, and perspective needs of the labor market against the background of the innovative economy development is considered essential for raising the efficiency of the lifelong learning system in Ukraine (Lukyanova, 2019, p. 18). Both in the US and

Ukraine, IT continues to present challenging career opportunities, and new computing-related fields are emerging. IT management, a quite new field that combines the components of both IT and management, urgently requires professionally trained specialists. To expand existing IT and management programs, and develop new ones directly focused on IT management is a way to meet the labor market needs in IT managers. Our study has showed that reforms in IT and management fields of study are in progress in Ukraine. In particular, computing program subject areas have been mostly harmonized with international Computing Curricula. However, we can conclude that transformations in computing-related subject areas remain a disputable issue, and the subject areas are still lacking the weighty business component. The findings confirm that further studies could focus on analysis of the IT management programs available in Ukraine as well as the ways in which Ukrainian universities could incorporate the US practices into their IT and management programs to train future IT managers.

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