



UDC 004.2

UKRAINIAN IT STUDENTS AND PROJECT MANAGEMENT: ARE THEY PREPARED FOR INDUSTRY DEMANDS?

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Abstract. This study investigates the readiness of Ukrainian IT students, particularly software engineering undergraduates, for effective participation in project management within the IT industry. Given the increasing importance of project management competencies, the research identifies a significant gap between the knowledge and skills acquired during university education and the expectations of industry employers. The study employed a comprehensive survey approach involving 247 students from various Ukrainian higher education institutions. It assessed their project management knowledge and personality traits using the Big Five (OCEAN) model. Results indicate that students generally possess a low level of practical project management knowledge, with only 16.31% achieving satisfactory scores. Additionally, while certain personality traits, notably openness to new experiences and conscientiousness, showed a modest correlation with knowledge scores, their overall influence appears limited. The findings suggest an urgent need to revise academic curricula to include more practical project management training and exposure to real-world scenarios. Further research is recommended to validate the effectiveness of curricular enhancements and to explore additional factors that impact students' preparedness for industry demands.

Key words: big-five personality traits, project management, computer science, software engineering

Introduction.

During the full-scale Russian invasion of Ukraine, the country's IT sector remained one of the few industries growing, creating new jobs, launching projects, and attracting investments. Despite the war's impact on all sectors of the economy, the IT industry remains a crucial pillar of support for Ukraine. It has the potential to become a key driver of its future development.

Software engineering and project management are key areas of IT, and they are closely interconnected. Project management requires considering various aspects of societal activities related to the specific processes of a project's subject domain. Successful IT project execution depends on establishing practical and pragmatic workflows, including the development and maintenance of high-quality software. High-quality project management in IT requires several key competencies: a deep



understanding of the project's domain and technology stack, knowledge of team collaboration dynamics, proficiency in project execution under tight deadlines, and the ability to manage project constraints such as budget, resources, risks, and timelines (Горбатьюк, 2022). Currently, there is a gap between the training level of university graduates and the expectations of employers. Employers highlight that graduates often lack essential skills such as defining software project objectives, working effectively in teams, maintaining communication, and ensuring the timely completion and implementation of software products (Жекало, 2019).

As the IT profession continues to gain popularity, there is a growing need to strengthen the industry's human resource potential. It is crucial to enhance specialists' ability to quickly adapt to evolving working conditions in software engineering, especially within the project management framework.

Literature review

Software development in modern projects is typically carried out according to either Waterfall or Agile methodologies, which require project participants to possess the necessary knowledge, skills, and abilities (IEEE Computer Society, 2024). Some authors claim that Scrum is the most popular methodology in Ukraine (Корогод et al., 2023, p. 234), and large companies, such as GlobalLogic, have already adopted the SAFe framework and utilise it for their large-scale projects (Присяжнюк & Безименний, 2021, p. 551). Other large companies, such as UKRSIBBANK BNP Paribas Group, are still undergoing their Agile transformation.

The increasing demand for IT specialists proficient in modern methodologies has prompted several Ukrainian companies to establish training centres. Major firms such as SoftServe, EPAM, GlobalLogic, Intellias, and Luxoft are among them. Additionally, in 2022, Ukraine launched the IT Generation educational project (Міністерство цифрової трансформації України, n.d.), targeting individuals with no prior experience in IT, known as “switchers.” This joint initiative, led by the Ministry of Digital Transformation, Binance Charity, and the Lviv IT Cluster, enabled 1,877 students to complete their training, with 147 graduates successfully securing employment in the IT sector.



Many graduates secured roles in Project/Product Management, HR, and JavaScript development. Employers included companies and startups such as LTI Mindtree, BehaviorQuant, Heimdal Data, ChoiceQR, NIX, Netpeak Agency, OmiSoft, and others. The highest employment rates were among graduates from GoIT (20.6%), Source IT (19%), and A-Level (15.7%). However, 323 students were unable to complete their studies, primarily due to challenges related to Russian aggression, such as power outages and relocation or personal difficulties. Most of these students were enrolled in front-end development programs (Сабадишина, 2023).

The IT sector employs 3.46 million specialists, with 3.01 million holding higher education degrees, accounting for 87% of the workforce (IT Ukraine Association, 2023). According to the National Agency for Quality Assurance in Higher Education Statistics, 781,286 individuals in Ukraine obtained a bachelor's degree in 2023 (Національне агентство із забезпечення якості вищої освіти, 2024).

According to the Stack Overflow Developer Survey, which gathered responses from over 70,000 participants, 70% of developers hold a higher education degree. The survey organizers emphasize that higher education offers numerous benefits, including a solid theoretical foundation and the chance to be part of a community of ambitious students and experienced instructors. This environment facilitates the formation of valuable connections with classmates, mentors, guest lecturers, and faculty who provide insights into current technologies, frameworks, and internship opportunities. Moreover, the experience of working on team-based projects develops technical and interpersonal skills. At the same time, advanced mathematical training — essential for fields like Machine Learning, Data Science, and Big Data — further enriches a programmer's expertise. Additionally, obtaining a degree can open doors to specialized job opportunities, including positions in the public sector, and university programs often introduce students to a wide range of IT disciplines, helping them identify the area in which they wish to develop further (ІТ-рекрутингове агентство "ІТExpert," 2023).

Employers expect that during their studies at higher education institutions, future software engineering graduates will acquire the essential foundational knowledge



required for their professional careers (Міністерство освіти і науки України, 2014). However, there are challenges in IT education that need to be addressed, including the lengthy duration of undergraduate programs, a lack of practical experience, and limited exposure to real-world cases.

In addition to professional skills, the personal component plays a crucial role in readiness for project management. This aspect can be assessed in future software engineering graduates using the "Big Five" model, the Five-Factor Model of Personality, or OCEAN. This model evaluates individuals based on five traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism (Goldberg, 1993). Some researchers suggest that “the way project managers perceive uncertainty depends on personal skills, intuition, and judgment” (Perminova et al., 2007), highlighting the importance of personal attributes alongside professional competencies.

Studies indicate that the most sought-after qualities in experienced project managers are openness and neuroticism (De Moura et al., 2019). Similarly, research on the personal traits of software engineers has found that those in leadership positions, such as Team Leads or Tech Leads, tend to exhibit higher levels of extraversion and conscientiousness (Smith et al., 2016, p. 17). Additionally, some studies emphasize the significant impact of project management behavioural competencies on organizational performance (Stojiljković, 2022), suggesting that improving employees' knowledge in project management could enhance productivity. Other research focuses on developing soft skills in future graduates to strengthen their expertise (Glazunova et al., 2022). However, these studies do not directly address whether personal qualities influence an individual's level of technical knowledge and skills.

Thus, it is essential to examine both the practical project management skills level among future software engineering graduates and the extent to which their personal qualities align with the Big Five model.

The primary objective of this study is to assess the readiness of future software engineering graduates for project management. To achieve this, we aim to answer the following research questions:



RQ1: To what extent are the Big Five personality traits expressed in future software engineering graduates?

RQ2: Can future software engineering graduates successfully identify management solutions in simulated production scenarios?

RQ3: Is there a correlation between the personal qualities of future software engineering graduates and the number of correctly solved management tasks?

RQ4: Do software engineering students demonstrate higher project management knowledge than students from other specialties?

Methodology

Population and sample

The study sample consists of 247 students from the 1st to 4th years of higher education institutions in Ukraine, including Vinnytsia National Technical University, Tavria State Agro-Technological University, named after Dmytro Motornyi, and Lutsk National Technical University. The number of students and their distribution by specialty and year of study are presented in Table 1.

Students participated in a Google Forms survey, answering 16 questions categorized into four sections: organizational questions, questions related to personal qualities, questions assessing project management knowledge, and creative questions that did not influence the knowledge assessment.

Each test question included the following parameters:

Question text – The specific question the student must answer.

Explanation – Additional context or clarification for the question.

Question type – Whether the question was required or optional.

Answer type – The format in which responses were collected, which included:

- **Checkbox** – A binary option (checked or unchecked).
- **Free input field** – An open text field without restrictions.
- **Combo box** – A drop-down list with a single selectable answer.
- **Likert scale** – A 1 to 5 scale, where one represents "Strongly disagree" and five represents "Strongly agree."
- **Multiple checkboxes** – A list allowing the selection of multiple answers.



Answer options – A predefined list of choices available for selection

Table1 - Student sample data

Specialty	Year of Study	Number of students
121 Software Engineering	2nd year	23
121 Software Engineering	4th year	10
121 Software Engineering	1st year	52
121 Software Engineering	3rd year	30
122 Computer Science	3rd year	7
122 Computer Science	2nd year	32
122 Computer Science	1st year	10
122 Computer Science	4th year	5
123 Computer Engineering	3rd year	14
123 Computer Engineering	2nd year	18
123 Computer Engineering	1st year	25
123 Computer Engineering	4th year	13

Data collection tools

The responses to the questions in the 'Organizational Questions' section (see Table 2) were used to categorise the results for further analysis. The primary objective of this section was to gain a deeper understanding of the demographic and academic background of the participants involved in the study.

All questions in this section were mandatory, ensuring that students could not submit their test results without providing answers to these questions.

Likert scale, CBM – Checkbox multiple answers

Additionally, the survey included five self-assessment questions to evaluate students' personal qualities. Each question corresponded to one of the Big Five personality traits, allowing students to express their level of agreement with each statement using a Likert scale.



Table 2 - Organizational questions

Question text	Explanation	Answer type (*)	Answer options
Do you consent to the processing of your personal data?		CB	blank or yes
Please indicate the number of the specialty you are studying.	For example, 121, 122, 123, and so on.	FI	
Please indicate the course you are currently studying.		CM	1st year 2nd year 3rd year 4th year

* Answer type: CB – two-state checkbox, FI – free input, CM – combobox

All questions in this section shared common characteristics: they were mandatory, and responses were recorded using a Likert scale ranging from 1 to 5, where one represented ‘Completely disagree’ and five represented ‘Completely agree’.

All questions in this section were mandatory and used a Checkbox response type, allowing students to select an unlimited number of answers.

Question Text: “Q1. A customer requests a dedicated team of five people, comprising three developers and two QA specialists, for a period of 1.5 years. In the contract terms, the customer wants to include a warranty clause requiring the team to fix any identified bugs for a period of two months after project completion.

What would be your course of action?”

Explanation: Choose two answers.

Answer Options:

- Offer an alternative contract type, such as a fixed-price or time-and-materials contract.
- Agree with the proposed conditions.
- Propose adding another project manager to oversee the team's quality.



- Suggest splitting the contract into two separate agreements: one for the dedicated team and another for maintenance.

Table 3 - Questions on assessing personal qualities

Question text	Explanation
I am organised	I always make plans and stick to them. I am diligent and attentive in my work. I prefer to finish tasks before relaxing or having fun.
I am open to something new	I enjoy exploring new cultures and ideas. I often think about abstract concepts and theories. I am open to trying new foods and activities.
I am emotionally resilient	I rarely feel tense or nervous. I rarely get anxious about things. I am difficult to get me out of my emotional balance.
I am an extrovert	I feel energised by socialising. I enjoy being around other people. I am outgoing and open in social situations.
I am conscientious	I am compassionate towards others. I trust people easily. I value harmony and cooperation in relationships.

Questions to test knowledge in the field of project management

Question Text: “Q2. Following a retrospective meeting, the team expressed a need to understand the customer's strategic plans. As a project manager, whom would you approach for this information?”

Explanation: "Select one answer."

Answer options:

The project sponsor

The business analyst

The architect



One of the stakeholders

Question Text: "Q3. A business analyst approaches you with a problem: two different stakeholders want to modify the system in ways that conflict with each other's requirements. All attempts by the business analyst to reconcile the requirements have been unsuccessful. As a project manager, what would you do?"

Explanation: "Select one answer."

Answer options:

Organise a joint call with both stakeholders and the business analyst, acting as a moderator or referee.

Organize a joint call with all stakeholders, including the business analyst and the project sponsor, as a referee.

Organize a joint call with both stakeholders and you to attempt to reach a mutually agreeable solution.

Suggest that the business analyst put these tasks on hold.

Question Text: "Q4. While analysing the specifications of the SMS provider planned for integration, one of the developers identified a potential risk that not all SMS messages may be delivered. What would be your course of action?"

Explanation: "Select one incorrect answer."

Answer options:

Change the SMS provider to another one.

Refuse the integration.

Accept the risk.

Avoid sending anything important via SMS.

Question Text: "Q5. The client has requested a high-level and rapid assessment of two major upcoming project features: breaking a monolith into microservices and upgrading to the latest major versions of the used frameworks. What estimation approaches can be used if the project follows an iterative development approach?"

Explanation: "Select two answers."

Answer options:

T-shirt size estimate



COCOMO modeling

Top-down estimate

Critical Path Method (CPM)

Question Text: "Q6. You are involved in planning the launch of a new project that involves developing firmware for medical equipment to automate the chemotherapy process. According to estimates, this project is expected to take four years of development and will involve a team of approximately 100 people, including developers, QA specialists, and other relevant personnel. Which development approach would you choose?"

Explanation: "Select two answers."

Answer options:

Waterfall

Scrum

SAFe

Kanban

Question Text: "Q7. You have been appointed as the project manager for a startup tasked with developing a revolutionary new social media platform. In the initial planning stage, create a concise, one-page document that outlines the project's value proposition, infrastructure, customers, and financial aspects. Which document will you prepare?"

Explanation: "Select one answer."

Answer options:

Business case for the project

Business Model Canvas

Project brief

Project charter

Question Text: "Q8. You have been appointed as the project manager for the development of a new productivity tool for remote teams. The project comprises multiple development phases and necessitates coordination among various teams. Which document will you present to the teams to outline key deliverables and major



decision points of the project?"

Explanation: "Select one answer."

Answer options:

Business case for the project

Business model

Project brief

Project roadmap

Creative questions

The answer type in this section was also a Checkbox, allowing respondents to select an unlimited number of answers.

Question Text: "Q9. Below are potential value propositions for Amazon's online store. Which of these would you select as the primary ones?"

Explanation: "The number of answers is not limited."

Answer options:

Increasing the profitability of Amazon's other subsidiaries (products, cloud technologies, etc.)

Eliminating conventional brick-and-mortar stores as a phenomenon

Reducing the carbon footprint

Collecting and utilising users' personal data

Question Text: "Q10. You are managing a project to develop a new mobile application for a transportation company similar to Uber. Which of the following statements about the app's value are correct?"

Explanation: "Select two answers."

Answer options:

Value is determined exclusively by the financial benefits for the transportation company.

Value includes outcomes such as improved fleet management efficiency.

Value should only be assessed from the perspective of the transportation company.

Value includes outcomes such as real-time customer tracking.



Experiment organisation

The description of the created Google Form included information about the data collected in the test and its purpose. Additionally, students were informed that the survey results would not affect their grades. The number of questions and the estimated time required to complete the survey were also provided.

The survey was anonymised: students were not asked for personal data such as their names or surnames. To further enhance anonymity, university names were not included; only the specialty number and the year of study were recorded.

As part of the experiment's organisation, a pilot test was conducted. It was verified that the Google Form was accessible online, could be completed and submitted, and that the results could be exported and analysed. To ensure that the pilot test results did not influence the final survey results, respondents did not provide consent for the processing of their personal data (as indicated in one of the survey responses), which, according to the rules, excludes such responses from the dataset.

Emails were sent to university representatives containing information about the test organisers, the scientific purpose, and the intended respondents, including their specialties and academic years. Along with this information, a request was made to distribute the survey link among students.

Analysis of results

All responses were exported from the Google Form as a comma-separated values (CSV) file. Further processing was carried out in Microsoft Excel using Data Transformation and Power Query Editor. Additionally, the R programming language was used to obtain part of the results.

The first step involved filtering out all invariant responses. These included responses where students did not provide consent for the processing of their personal data and those where the course and/or specialty could not be identified.

Next, the responses assessing project management knowledge were analysed. A correct answer received 1 point, while an incorrect answer received 0 points. For questions with multiple correct answers, if a student failed to select all the proper options or provided a partially correct response, 0 points were assigned.



The maximum possible score for correctly answering all questions was 8 points.

Results

After analysing the survey results, some respondents were excluded. The final calculations were conducted on a sample of 239 respondents.

The Table 5 represents the results of students' personal qualities self-assessment.

Table 5 - Distribution of students' personal qualities assessments

Criteria	Completely disagree (1)	2	3	4	Completely agree (5)	Mean
I am organised	5	32	85	76	41	3.49
I am open to something new	9	24	58	82	66	3.72
I am emotionally resilient	23	42	71	55	48	3.26
I am an extrovert	34	48	75	51	31	2.99
I am conscientious	13	34	57	83	52	3.53

Scores

According to the measurement results presented in Table 6, the average score for correctly answered questions among students is 2.27 out of a maximum of 8. A total of 68 students received a score of 0, meaning they did not answer any questions correctly. Only 39 students achieved a score of 4 or higher (50% or more), accounting for just 16.31% of the total sample.

Table 6 - Table of student score distribution

Score	0	1	2	3	4	5	6	7	8
Percentage score	0	12.5	25	37.5	50	62.5	75	87.5	100
Number of students	68	71	61	27	11	0	1	0	0

Based on the Shapiro-Wilk test, the distribution of student scores is not normal ($W = 0.93823$, $p\text{-value} = 1.723e-08$), which limits the applicability of specific statistical analysis methods.



The percentage grade is calculated as the percentage of correct answers, where 100% represents the maximum possible score, and 0% represents the minimum score.

Table 7 - Correlations Between Scores and OCEAN Components

Component	Rho, correlation coefficient	P-value
Openness	0.1924492	0.002812**
Conscientiousness	0.1634387	0.01139*
Extraversion	0.01822533	0.7792
Agreeableness	0.1101149	0.0894
Neuroticism	0.1176773	0.06937

** 0.01 significant

* 0.05 significant

According to the results of Spearman's test (Table 7), only openness to new experiences and conscientiousness were found to be statistically significant components. However, the correlation coefficients are relatively small, suggesting that these personality traits have only a limited impact on the number of correctly solved tasks.

The Spearman test results between openness to new experiences and conscientiousness indicate a possible relationship between these traits ($\rho = 0.3108978$, $p\text{-value} = 9.428e-07$). These results are statistically significant, and the correlation coefficient exceeds 0.3. Such findings suggest a link between these personality traits or may point to potential imperfections in the testing methodology.

Additionally, a multiple regression analysis (Table 8) revealed that openness to new experiences was statistically significant. However, the coefficient of determination (R-squared) is only 0.04922, while the P-value is 0.04922, indicating a weak explanatory power of the model despite statistical significance.

These results suggest that students' scores are also influenced by factors not accounted for in the model.

The results of comparison of Comparison of scores between Software Engineering and other (Table 9) specialties shows the mean score difference of 0.01.

**Table 8 - Linear regression between the score and the OCEAN components**

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.93938	0.38187	2.460	0.0146 *
Openness	0.21321	0.08741	2.439	0.0155 *
Conscientiousness	0.16919	0.09316	1.816	0.0706
Extraversion	-0.13831	0.08136	-1.700	0.0904
Agreeableness	0.05293	0.08692	0.609	0.5432
Neuroticism	0.05525	0.07509	0.736	0.4626

** 0.01 significant

* 0.05 significant

Table 9 - Comparison of scores between Software Engineering and other specialties

Criteria	Software Engineering	Other specialties
Average score	2.27	2.28
Group size	115	124

Using the empirical distribution function, graphs were constructed for both groups (Figure 1). As observed, they share similar characteristics, with only minor differences in the score range of 1 and 2, which do not significantly affect the final result but rather confirm the generally low level of knowledge among students.

Discussion

The study revealed a small correlation between certain components of the Big Five personality traits and the scores received by students. At the same time, the scores themselves showed that 28% of students did not answer a single question correctly, and only one student achieved a percentage score above 65%. These low results indicate that the expected learning outcome of "knowing and being able to apply project management methods and tools" (МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ, 2018) can and should be improved.

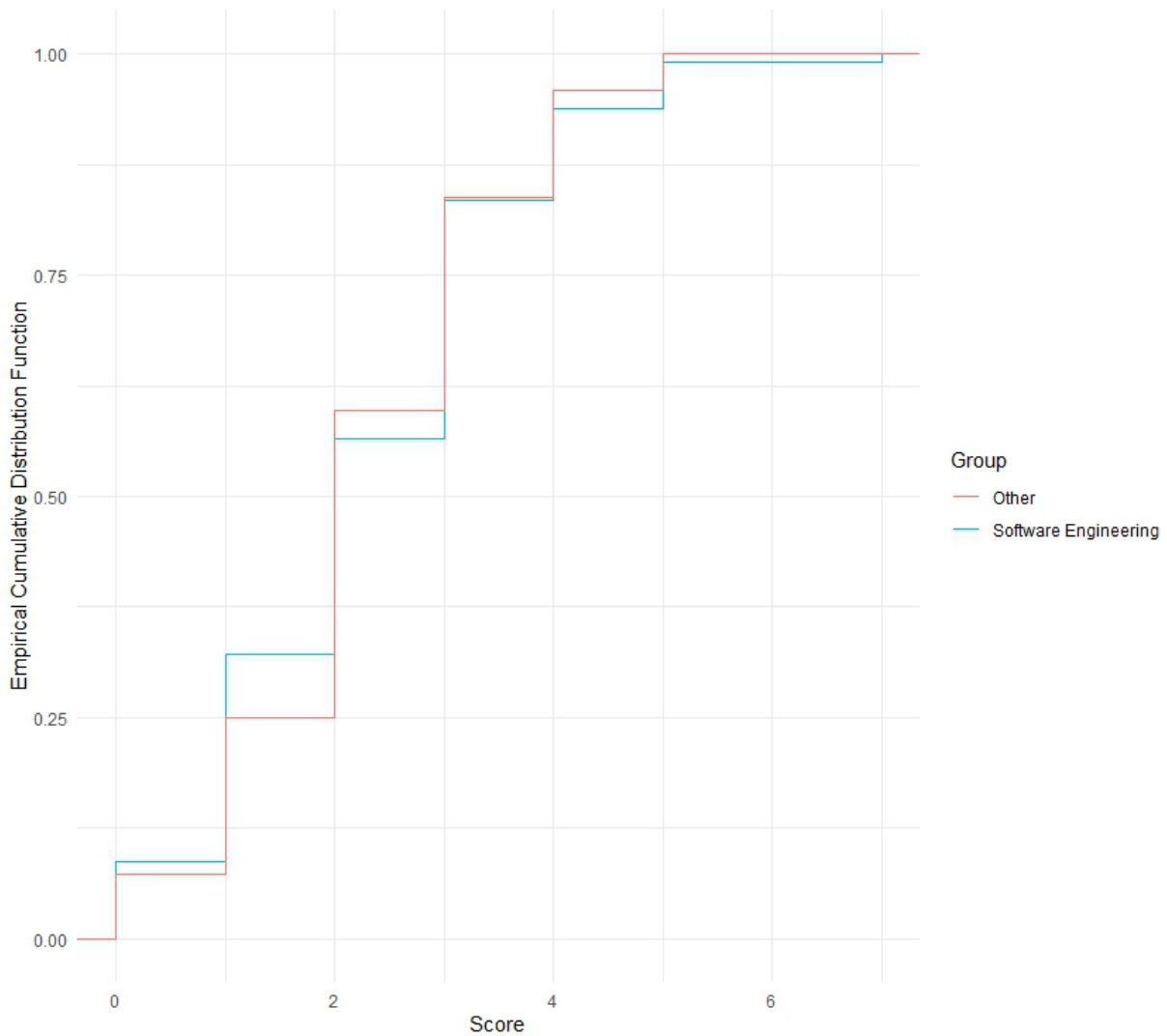


Figure 1 - Graphical representation of the empirical cumulative distribution functions

Based on the results, it can be concluded that students of selected IT specialties are currently unable to find appropriate management solutions in simulated production scenarios. Additionally, the performance of students in the "Software Engineering" specialty did not significantly differ from that of students in other fields, which may point to a broader academic issue in project management education.

However, the accuracy of the assessment results may be limited, as this testing did not affect students' academic grades. Therefore, some participants may have acted irresponsibly or chosen random answers, which could have influenced the final outcomes of the study.



In the part of the study focused on students' personal traits, it was confirmed that all five components of the Big Five personality model are present among the students. It was also found that certain traits—such as Openness and Conscientiousness correlate with the results of the knowledge assessment. However, this influence is minimal ($Rho = 0.1924492$ and $Rho = 0.1634387$, respectively).

These findings are based on students' self-assessments using the Likert scale, which does not allow for a comprehensive analysis of their characteristics within the Big Five model. Students selected answers based on their own perceptions, and these responses were not subject to further verification. As a result, it is not possible to make definitive conclusions about the impact of the Big Five personality traits on the quality of students' academic performance.

Conclusion

Despite the high importance of project management as a core process in IT companies, the results indicate that students in IT-related fields do not possess an adequate level of knowledge in this area. This highlights a lack of readiness among future bachelor's graduates and points to the need for changes in the academic curriculum to improve the level of relevant knowledge.

The low correlation values between personal traits (based on the Big Five model) and knowledge in the field of project management suggest that students tend to rely primarily on their personal qualities rather than structured learning to develop project management readiness.

We see prospects for further research in revising the academic curriculum to enhance students' knowledge in project management, followed by subsequent assessment of the effectiveness of these improvements.

References

1. IT Ukraine Association. (2023). Digital Tiger: The Power of Ukrainian IT. Research for 2023. In *IT Ukraine Association*. Retrieved April 20, 2025, from https://itukraine.org.ua/files/ITU_GT.pdf
2. IEEE Computer Society. (2024). Guide to the Software Engineering Body of



Knowledge (SWEBOOK Guide) (4th ed.). <https://www.swebok.org>

3. Національне агентство із забезпечення якості вищої освіти. (2024). Доповідь про якість вищої освіти в Україні, її відповідність завданням сталого інноваційного розвитку суспільства у 2023 році [Report on the quality of higher education in Ukraine, its compliance with the tasks of sustainable innovative development of society in 2023]. Retrieved April 20, 2025, from <https://naqa.gov.ua/wp-content/uploads/2024/05/%D0%94%D0%BE%D0%BF%D0%BE%D0%B2%D1%96%D0%B4%D1%8C-2023-%D1%80%D0%BE%D0%BA%D1%83.pdf>

4. Сабадишина, Ю. (2023, July 24). В Україні завершився освітній проєкт IT Generation. Найбільше випускників — Front-end, QA, UI/UX Design. *DOU*. <https://dou.ua/lenta/news/it-generation-results/>

5. Міністерство цифрової трансформації України. (n.d.). *IT generation*. Retrieved April 20, 2025, from <https://it-generation.gov.ua/>

6. Корогод, Н. П., Швець, Є. С., & Виноградова, В. К. (2023). Специфіка ефективного управління IT-проєктами у компанії [Specifics of Effective IT Project Management in a Company]. In зб. *наук. праць за матеріалами V Міжнар. наук.-практ. інтернет-конф. (Київ-Дніпро, 23–24 березня, 2023 р.)*. Український державний університет науки і технологій, Дніпро; ЮРСЕРВІС. <https://crust.ust.edu.ua/items/b74a0a54-1f69-4506-9cc0-72a6e9881496>

7. Присяжнюк, О., & Безименний, С. (2021). Інноваційні рішення в управлінні інвестиційними проєктами [Innovative decisions in investment project management]. *Економіка Та Суспільство*, 29. <https://doi.org/10.32782/2524-0072/2021-29-19>

8. De Moura, R. L., Carneiro, T. C. J., De Lemos Dias, T., & Oliveira, B. S. (2019). Traços de personalidade de gerentes de projetos: diferenças de conhecimentos, experiência profissional e setor de atuação. *Revista De Administração Da UFSM*, 12(4), 767–784. <https://doi.org/10.5902/1983465922096>

9. Smith, E. K., Bird, C., & Zimmermann, T. (2016). Beliefs, practices, and personalities of software engineers. *Association for Computing Machinery*, 15–18.



<https://doi.org/10.1145/2897586.2897596>

10. Горбатюк, І. (2022). Особливості проєктного управління в контексті інженерії програмного забезпечення [Peculiarities of project management in the context of software engineering] *Наукові записки Бердянського державного педагогічного університету. Педагогічні науки*, (3), 267-274.

11. Glazunova, O. G., Korolchuk, V. I., Voloshyna, T. V., & Vakaliuk, T. A. (2022). DEVELOPMENT OF SOFT SKILLS IN COMPUTER SCIENCE BACHELORS IN THE PROJECT LEARNING PROCESS. *Information Technologies and Learning Tools*, 92(6), 111–123. <https://doi.org/10.33407/itlt.v92i6.5076>

12. Perminova, O., Gustafsson, M., & Wikström, K. (2007). Defining uncertainty in projects – a new perspective. *International Journal of Project Management*, 26(1), 73–79. <https://doi.org/10.1016/j.ijproman.2007.08.005>

13. Stojiljković, S. (2022). The research of Behavioral project management competencies. *European Project Management Journal*, 12(1), 70–77. <https://doi.org/10.56889/lewr1634>

14. Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist*, 48(1), 26–34. <https://doi.org/10.1037/0003-066x.48.1.26>

15. Жекало, Г. І. (2019). Цифрова економіка України: проблеми та перспективи розвитку. [Digital Economy of Ukraine: Problems and Prospects of Development] *Міжнародні Економічні Відносини Та Світове Господарство*, 26. <https://dspace.uzhnu.edu.ua/jspui/handle/lib/27376?mode=full>

16. ІТ-рекрутингове агентство “ІТExpert.” (2023, November 29). Вступати чи не вступати: чи потрібна вища освіта програмісту? Думки фахівців [To enter or not to enter: does a programmer need higher education? Expert opinions]. *ІТ-рекрутингове агентство “ІТExpert.”* Retrieved April 20, 2025, from <https://itexpert.work/uk/vstupaty-chy-ne-vstupaty-chy-potribna-vyshha-osvita-programistu-dumky-fahivcziv/>

17. Міністерство освіти і науки України. (2014, December 13). *ПРОФЕСІЙНИЙ СТАНДАРТ: Фахівець з розробки програмного забезпечення [Professional Standard: Software Development Specialist]*. Retrieved April 20, 2025,



from <https://mon.gov.ua/static-objects/mon/sites/1/vyshcha/IT-prof-standarty/6-ps-rozrobnik-pz-13.12.2014.pdf>

18. МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ. (2018). Стандарт вищої освіти України: перший (бакалаврський) рівень, галузь знань 12 – Інформаційні технології, спеціальність 121 – Інженерія програмного забезпечення [Ukrainian higher education standard: first (bachelor's) level, field of knowledge 12 – Information Technology, specialty 121 – Software Engineering]. Retrieved April 28, 2025, from <https://mon.gov.ua/static-objects/mon/sites/1/vishcha-osvita/zatverdzeni%20standarty/12/21/121-inzhener.programn.zabezp.bakalavr-1.pdf>