Skills- and competencies needs analysis for the Application Developer Profile

Publication date: February 2024
Research period: October 2023-January 2024

Table of Contents

1 Executive Summary

The survey aimed to discern the key competencies and skills valued in the ICT sector, with a focus on coding and application development roles. Conducted across 32 companies from Kosovo and international regions such as Switzerland, Austria, Germany, and the USA, the study sought to bridge the gap between vocational education and training (VET) and the industry's evolving demands. This research is particularly pertinent in the context of enhancing the dual VET system in ICT, ensuring that educational curricula are aligned with real-world requirements.

Highly Relevant Skills:

The data indicates that certain skills are of paramount importance, receiving average scores exceeding 4.16, which categorizes them as "Highly Relevant." These include:

- **Agile Methodologies**: The ability to develop software iteratively using agile practices received the highest score (4.63), highlighting the industry's shift towards flexible, adaptive project management and development processes.

- **Object-Oriented Design and Data Modeling**: Skills in designing and implementing object-oriented software (4.41) and data models (4.47) are highly prized, reflecting the need for scalable, maintainable, and robust software systems.

- **Application Security**: Implementing security measures in applications scored 4.44, underlining the growing emphasis on cybersecurity in software development.

- **Web Development and UI Design**: Developing web applications with a focus on functionality, security, and testing (4.28), along with the ability to craft dynamic web pages (4.25) and design user interfaces (4.16), indicates the critical role of web technologies and user experience in the ICT sector.

- **Independent Project Execution**: The capability to independently plan, execute, and document ICT tasks, including designing, implementing, and testing applications for multiple users, each scored 4.25, pointing to the importance of autonomy and comprehensive project management in the field.

Moderately Relevant Skills:

The survey also identified a range of skills with average scores between 3.5 and 4.15, categorized as "Moderately Relevant." These include project management, data evaluation, database architecture, and mobile application development, among others. While these skills are important, their perceived relevance varies more significantly across different roles and projects compared to the highly relevant skills.

Slightly Relevant Skills:

Skills with average scores below 3.5 were deemed "Slightly Relevant," suggesting that their importance might be more niche or context-dependent. This category includes network installation and management, market analysis, and e-business application customization. The lower prioritization of these skills suggests they might be specialized areas within the ICT sector, not universally required but potentially critical for specific roles or industries.

The diversity in skill relevance underscores the necessity for a VET curriculum that not only focuses on core competencies but also offers flexibility and specialization to cater to the dynamic nature of ICT roles.

Recommendations for the Dual VET Education System in ICT:

1. **Curriculum Development:**

   - Integrate hands-on training in agile methodologies and object-oriented design, reflecting the high demand for these skills.

   - Embed principles of application security to prepare students for developing secure software.

2. **Industry Collaboration:**

   - Strengthen partnerships with ICT companies to ensure curriculum relevance and incorporate real-world insights into VET programs.

   - Establish feedback mechanisms with industry stakeholders for continuous curriculum updates.

3. **Specialization and Flexibility:**

   - Adopt a modular curriculum design that allows for specialization in high-demand areas while covering foundational ICT skills.

   - Include elective modules on niche skills to accommodate diverse student interests and emerging industry trends.

4. **Soft Skills Integration:**

   - Incorporate training in soft skills like teamwork and problem-solving to complement technical competencies.

5. **Continuous Professional Development:**

   - Facilitate lifelong learning opportunities through advanced courses and workshops to keep pace with technological advancements.

6. **Research and Innovation:**

   - Promote applied research within VET institutions to foster innovation and address real-world ICT challenges.

7. **Policy and Funding Support:**

   - Engage policymakers to ensure adequate support and recognition for ICT VET programs.

   - Secure investments for modern learning facilities and resources to enhance the educational environment.

The key takeaway from these findings is the clear indication of which competencies are currently in high demand within the ICT sector. This insight is invaluable for guiding the development and refinement of curricula in vocational education and training (VET) programs, particularly those focused on software development. By aligning educational outcomes with these industry-valued skills, VET programs can better prepare students for successful careers in the ICT sector, ensuring they possess the competencies most sought after by employers.

By implementing these recommendations, the dual VET system in ICT can be significantly enhanced, aligning education with industry needs and preparing students for successful careers in the digital economy.

2 Introduction

In an era defined by rapid technological advancements, the alignment of vocational education and training (VET) with the dynamic demands of the labor market becomes imperative, particularly in the field of Information and Communication Technology (ICT). SHPIK, the Association of Kosovo Informaticians, stands at the forefront of this transformative endeavor. As a leading force in Kosovo's digital transformation, SHPIK is not just crafting curricula and developing a Dual VET model specifically for the ICT sector; it is also ensuring that Kosovo's ICT vocational education and training (VET) system is in harmony with both local and global market demands. This alignment is based on in-depth industry collaboration and market analysis, guaranteeing that the education provided is attuned to the essential competencies needed in today's digital era. SHPIK's commitment to enhancing digital literacy and competence is not confined to national efforts; it extends to significant contributions on the global stage, actively participating in international initiatives and shaping the discourse on digital education both within Kosovo and internationally.

Background

SHPIK's mission is deeply integrated into the broader narrative of digital transformation across Kosovo. By spearheading initiatives aimed at enhancing the ICT curricula across VET schools, SHPIK endeavors to equip the future workforce with the requisite skills and knowledge to thrive in the digital economy. This mission is further bolstered by SHPIK's collaboration with key stakeholders, including the Ministry of Education, Science, Technology, and Innovation (MESTI), with whom it has forged a partnership to develop coding curricula for K-12 education and introduce computer science into pre-university education curricula. Such initiatives underscore SHPIK's commitment to nurturing a digitally literate society, poised to contribute to the global digital economy.

Rationale for the Survey

The rationale for conducting this extensive survey stems from the imperative need to ensure that the ICT VET education system in Kosovo is in harmonious alignment with the evolving requirements of the global software development industry. Recognizing the significance of the dual VET model, as exemplified by countries such as Switzerland, Austria, and Germany, SHPIK embarked on this research endeavor to bridge the gap between educational outcomes and industry expectations. The survey, encompassing responses from over 40 prominent companies in the field of software development, including international firms from Switzerland, Austria, Germany, and the USA, serves as a cornerstone in understanding the current and future demands of the ICT sector.

Objectives of the Research

The primary objectives of this research are manifold:

1. **To Map Current Industry Standards and Expectations**: By analyzing the responses from leading companies in the software development sector, the survey aims to delineate the specific skills, competencies, and knowledge areas that are in high demand within the industry.

2. **To Identify Gaps in Existing ICT VET Curricula**: Through a meticulous comparison of the survey findings with the current ICT VET education framework in Kosovo, the research seeks to uncover any discrepancies or gaps that may exist, thereby providing a roadmap for curriculum enhancement.

3. **To Facilitate Curriculum Development**: Leveraging insights derived from the ESCO and O*NET frameworks, alongside the best practices from the dual VET systems of Switzerland,

Austria, and Germany, the research intends to inform the development of a more robust, industry-aligned ICT VET curriculum.

4. **To Foster Industry-Academia Collaboration**: By incorporating feedback and suggestions from industry stakeholders, the survey endeavors to foster a closer collaboration between academia and the software development sector, ensuring that the educational offerings remain relevant and responsive to market needs.

In summary, this research embodies SHPIK's unwavering commitment to advancing ICT education in Kosovo, aligning it with the requisites of the global digital economy and ensuring that the nation's youth are well-prepared to navigate and contribute to the digital future.

3 Methodology

3.1 Survey Design

The research methodology for this study was intricately crafted to provide a thorough evaluation of the essential skills and competencies for coding and application development roles within the ICT sector. Recognizing the pivotal role of vocational education and training (VET) in bridging the gap between academic achievements and the dynamic needs of the labor market, especially in ICT, the survey was meticulously structured to reflect the industry's continuously evolving demands.

The development of the survey framework began with an in-depth analysis of the ICT VET education systems in countries renowned for their dual VET models, such as Switzerland, Austria, and Germany. This examination included a review of the curricula, educational standards, and competency frameworks established in these nations, ensuring that the competencies assessed were relevant and adaptable to the Kosovar context.

To build a solid foundation for the survey, the study delved into the occupation of software development and the role of application developers, drawing from the competency descriptions outlined in the European Skills, Competences, Qualifications and Occupations (ESCO) framework and the O*NET database. This comprehensive examination aimed to align the survey with recognized international standards and best practices in the ICT sector.

Further enriching the survey's foundation, qualitative research was conducted with ten renowned companies within the sector. This step allowed for the incorporation of direct industry insights into the survey design, ensuring that the questions were not only theoretically robust but also reflective of the current and future needs of the industry.

A total of 34 questions were developed, encompassing a broad spectrum of both technical and soft skills considered crucial for application developers. The questions were designed to assess the industry's valuation of each skill or competency, offering response options that ranged from "Highly Relevant" to "Not Relevant at All." This granularity aimed to provide detailed insights into how the industry prioritizes various skills, offering a nuanced understanding of the competencies most valued by professionals in the field.

Through this multifaceted methodology, the study sought to offer a nuanced and comprehensive perspective on the alignment of ICT VET education with the real-world demands of the ICT industry, thereby contributing to the enhancement of educational outcomes and better preparation of graduates for the labor market.

3.2 Survey Distribution

The survey targeted a diverse group of companies within the software development sector, extending beyond Kosovo to include organizations from Switzerland, Austria, Germany, and the USA. This international approach was adopted to garner a broader understanding of the skills and competencies valued globally within the ICT sector, thereby enhancing the applicability of the findings to the Kosovar context.

A total of 40 companies were initially approached to participate in the survey, with an eventual participation rate of 80%, resulting in 32 completed responses. The selection of these companies was based on their size, reputation, and influence within the software development industry, ensuring that the findings reflected the views of key industry stakeholders.

The distribution process involved a combination of electronic mailings and follow-ups to maximize response rates and ensure comprehensive coverage of the targeted industry segment.

3.3 Data Collection and Analysis Methods

Data collection was conducted through an google forms online survey platform, facilitating ease of access for participants and efficient aggregation of responses. The platform was chosen for its robustness, user-friendly interface, and data analysis capabilities, ensuring the integrity and confidentiality of the data collected.

Upon completion of the data collection phase, the responses were subjected to a rigorous analysis process. Descriptive statistical methods were employed to summarize the data, with particular attention paid to the distribution of responses across the various relevance categories for each surveyed skill or competency. This approach provided a clear overview of industry preferences and priorities, informing the subsequent discussion and recommendations.

In addition to quantitative analysis, qualitative insights were also derived from open-ended responses and additional comments provided by participants. These narrative inputs were analyzed thematically to identify emerging trends, gaps in current education offerings, and potential areas for curriculum enhancement.

4 Analysis of ICT VET Education Systems in DUAL VET Countries

4.1 Overview of the ICT VET Education Systems

Switzerland

The Swiss Vocational Education and Training (VET) system is renowned for its robust dual education model, which combines workplace training with classroom instruction. In the context of ICT, the Swiss system offers specialized programs that cater to the burgeoning demands of the digital economy. Organizations like ICT Berufsbildung Schweiz play a pivotal role in developing curricula that align with industry needs, ensuring that apprentices are well-equipped with both theoretical knowledge and practical skills. The Swiss model emphasizes certifications and continuous education, enabling professionals to adapt to the rapidly evolving ICT landscape.

Austria

Austria's VET system shares similarities with the Swiss model, providing a blend of school-based education and workplace training. The Austrian approach to ICT education focuses on delivering comprehensive technical skills and fostering innovation. The system is characterized by its flexibility, allowing for the integration of new technologies and methodologies into the curriculum. Partnerships between educational institutions and businesses are crucial in Austria, ensuring that the curriculum remains relevant to the industry's needs.

Germany

Germany's dual system is the archetype for vocational education, with a strong emphasis on apprenticeships. The ICT sector benefits significantly from this model, with specialized training programs designed to meet the high demand for skilled professionals. The German approach is highly structured, with clear pathways and qualifications that are recognized by the industry. Collaboration between the government, educational institutions, and industry stakeholders is key to the system's success, facilitating a seamless transition from education to employment for ICT professionals.

4.2 Key Features of the Dual VET System and Its Relevance to the ICT Sector

The dual VET systems in Switzerland, Austria, and Germany share several key features that are particularly beneficial for the ICT sector:

- **Integration of Work and Learning:** Apprentices split their time between working in a company and learning in a vocational school, allowing them to apply theoretical knowledge in real-world scenarios.

- **Industry Involvement:** Businesses play a significant role in shaping the curriculum and providing training, ensuring that education aligns with current industry standards and needs.

- **Certification and Pathways:** These systems provide clear certification and career pathways, enabling individuals to progress in their careers through further education and training.

- **Adaptability:** The systems are designed to be responsive to technological advancements and changes in the labor market, making them highly relevant to the dynamic ICT sector.

4.3 Comparative Analysis with the Current State of ICT VET Education in Kosovo

Kosovo's ICT VET education system is in a phase of development, with significant efforts being made to align it with European standards and industry needs. Unlike the dual VET countries, Kosovo's system is currently more school-centric, with less emphasis on workplace training. However, initiatives like

those undertaken by SHPIK are crucial in bridging this gap, particularly through partnerships with industry stakeholders and international organizations.

One of the main challenges facing Kosovo is the need to integrate practical, hands-on experience into the ICT curriculum, a hallmark of the dual VET system. Additionally, fostering closer collaboration between educational institutions and the ICT industry could enhance the relevance and effectiveness of the VET system in Kosovo.

To align more closely with the dual VET models, Kosovo might consider:

- Enhancing industry involvement in curriculum development and training.

- Expanding opportunities for apprenticeships and workplace learning within the ICT sector.

- Establishing clear certification and career pathways that are recognized by the industry.

5 Survey Findings

This chapter presents a comprehensive analysis of the survey findings, focusing on the essential competencies and skills for coding and application development within the ICT sector as identified by the participating companies. We delve into a detailed examination of the responses, utilizing statistical tools to represent the data through graphs and charts, thereby providing a visual and quantitative understanding of the industry's current demands. Additionally, we explore the insights garnered from the participants' suggestions on additional skills and competencies, shedding light on emerging trends and requirements in the ICT landscape. This investigation not only highlights the core skills deemed indispensable by employers but also opens a window into the evolving dynamics of the ICT workforce.

5.1 Summary of Key Competencies and Skills

The survey conducted among 32 companies from Kosovo and abroad, including those from Switzerland, Austria, Germany, and the USA, has yielded significant insights into the competencies and skills deemed crucial in the ICT sector, particularly for roles related to coding and application development. The analysis of the survey responses highlighted a diverse range of technical and soft skills that are valued by industry stakeholders.

The scores range from 2.88 (Slightly Relevant) to 4.88 (Highly Relevant), indicating a diverse landscape of skill importance.

Highly Relevant Skills (Average Score ≥ 4.16):

- Developing software iteratively using agile methodologies (4.63)

- Designing and implementing object-oriented software (4.41)

- Designing and implementing data models (4.47)

- Implementing security measures in applications (4.44)

- Designing, implementing, and testing applications for multiple users (4.44)

- Developing web applications with a focus on functionality, security, and testing (4.28)

- Acquiring the ability to craft dynamic web pages (4.25)

- Independently planning, executing, and documenting ICT tasks (4.25)

- Designing and implementing user interfaces (4.16)

- Ability to design, implement, and test object-oriented programs (4.16)

- Ability to implement procedural program sequences (4.06)

- Designing and managing databases using SQL (4.09)

These skills are considered highly valuable in the current ICT landscape, suggesting a strong demand for professionals proficient in these areas.

Moderately Relevant Skills (Average Score 3.5 - 4.15):

- Managing ICT projects effectively (3.91)

- Accurately characterizing data and evaluating data quality (3.91)

- Developing the capability to design and deploy web pages (4.28)

- Acquiring proficiency in constructing and evaluating database architecture (4.22)

- Developing skills for encoding, compression, and encryption (3.81)

- Enhancing capabilities in setting up and troubleshooting hardware/software (3.19)

- Mastering essential skills for operating system management (3.09)

- Analyzing, documenting, and optimizing business processes (3.53)

- Creating user-friendly guides and instructions (3.50)

- Independently planning, executing, and documenting automated tasks (3.44)

- Developing and testing mobile applications (3.63)

These skills hold moderate relevance, indicating their importance in various roles but potentially not always being the core focus. Adapting expertise based on specific job requirements may be beneficial.

Slightly Relevant Skills (Average Score < 3.5):

- Acquiring the capacity to install and maintain ICT networks (3.06)

- Mastering skills for designing and managing ICT networks (2.94)

- Analyzing markets, economic principles, and financial indicators (2.88)

- Designing, developing, and testing applications for microprocessors (2.97)

- Learning how to develop and implement entrepreneurial vision (3.31)

- Customizing e-business applications (3.44)

The lower average scores for these skills suggest that their importance may vary depending on factors such as the specific services a company offers, its size, and other operational characteristics, warranting further investigation to understand these nuances. However, their relevance could vary depending on individual career paths and specializations.

Key Takeaways and Recommendations:

- Focus on developing highly relevant skills to increase employability and career advancement.

- Continuously update knowledge and skills in areas with moderate relevance to adapt to evolving industry needs.

- Consider personal interests and aptitudes when choosing which skills to prioritize.

5.2 Additional Skills and Competency Recommendations

Contextual Introduction

In the survey conducted to analyze skills and competencies for the Application Developer profile, participants were also provided with an open-ended question to suggest additional skills they deem necessary. The feedback received offers insightful perspectives on emerging trends and practical needs specific to businesses. Although a comprehensive second-round analysis of these suggestions through an additional survey was constrained by time, these insights have been earmarked for consideration in future research iterations.

GitHub/GitLab Proficiency

Participants emphasized the importance of proficiency in version control systems, specifically GitHub and GitLab. The ability to create and manage issues within these platforms was noted as crucial. Version control is not just about keeping track of changes — it facilitates collaboration, code sharing, and versioning, all of which are fundamental in modern development workflows. The feedback indicates that real-world application development increasingly relies on these tools, and as such, they should be integral to any ICT curriculum.

DevOps and Version Deployments

Respondents underscored the relevance of DevOps practices, particularly the deployment of new releases. They highlighted concepts and potential risk factors, the importance of monitoring post-deployment, and strategies for minimizing the risk of errors. This reflects a growing industry trend that values continuous integration and continuous delivery (CI/CD) pipelines in accelerating development cycles and improving the quality of software releases.

AI Knowledge and Application

Artificial Intelligence (AI) was noted for its dual role in both the enhancement of coding and testing practices and as a potential source of risks, such as unintentional code leaks. The nuanced understanding of AI's capabilities and its practical uses in troubleshooting day-to-day challenges was recommended as a key area of knowledge. This suggests a need for a balanced approach in education that covers both the potential and the pitfalls of AI in application development.

Code Analysis and Clean Code Practices

The ability to analyze existing code and the practice of writing clean code were highlighted as critical skills. Participants pointed out that these skills facilitate easier maintenance, faster onboarding of new developers, and overall improved code quality. Emphasizing proper naming conventions, clean loops, and clear spacing can significantly reduce time spent on debugging and reduce future confusion, thereby enhancing efficiency and productivity.

Security Focus

A strong focus was placed on security, including encryption, data breach prevention, retention, and backup procedures. The increasing prevalence of cyber threats makes these skills imperative for developers to protect sensitive data and maintain the integrity of applications. Additionally, cloud services were mentioned as a key area of competency, aligning with the industry's shift towards cloud-based architectures.

AI and Machine Learning

AI and Machine Learning (ML) were identified as areas of growing influence in the application development landscape. Understanding these technologies' impact on the development process and their role in creating more intelligent and responsive applications is becoming increasingly important.

Conclusion and Future Directions

While these additional skills and competencies were highlighted by respondents based on immediate business needs rather than broader industry trends, they present valuable directions for curriculum development. Recognizing the limitations of the current research phase, these insights will form a basis for a more detailed investigation in subsequent surveys. Future research will delve deeper into validating and prioritizing these skills within the curriculum development process for application developers, ensuring educational outcomes are closely aligned with the evolving demands of the ICT industry.

5.3   Detailed analysis of responses

The survey responses were analyzed to quantify the importance of each identified skill and competency. Responses were categorized as "Highly Relevant," "Relevant," "Moderately Relevant," "Slightly Relevant," and "Not Relevant at All." This categorization provided a nuanced view of industry priorities and preferences.

5.3.1   Question 1: Accurately characterize the structural aspects of data and data sets...

- Average Score: 3.91

- Response Distribution: Highly Relevant (18.75%), Relevant (62.5%), Moderately Relevant (12.5%), Slightly Relevant (3.13%), Not Relevant at all (3.13%)

- Key Insights: This skill is considered moderately relevant overall, but a significant portion (81%) find it relevant or highly relevant. This suggests data structuring and analysis are important within the represented companies.

Visualization: Bar chart showing response distribution.

5.3.2   Question 2: Develop the capability to design and deploy web pages...

- Average Score: 4.28

- Response Distribution: Highly Relevant (53.13%), Relevant (31.25%), Moderately Relevant (9.38%), Slightly Relevant (3.13%), Not Relevant at all (3.13%)

- Key Insights: This skill is considered more relevant than the previous one, with over half (53.13%) finding it highly relevant.

Visualization: Bar chart showing response distribution.

5.3.3   Question 3: Acquire proficiency in constructing, executing, and evaluating a database architecture...

- Average Score: 4.22

- Response Distribution: Highly Relevant (53.13%), Relevant (31.25%), Moderately Relevant (3.13%), Slightly Relevant (9.38%), Not Relevant at all (3.13%)

- Key Insights: Similar to web development, database skills are considered highly relevant by a majority (53.13%), indicating their importance in managing and storing information.

Visualization: Bar chart showing response distribution.

5.3.4   Question 4: Develop the skill to choose and utilize suitable encoding, compression, and encryption strategies...

- Average Score: 3.81

- Response Distribution: Highly Relevant (34.38%), Relevant (25%), Moderately Relevant (28.13%), Slightly Relevant (12.5%), Not Relevant at all (0%)

- Key Insights: While still considered relevant or highly relevant by most (59.00%), this skill has a slightly lower average score compared to the previous three.

Visualization: Bar chart showing response distribution.

5.3.5 Question 5: Acquire the capacity to install, maintain, deploy, calibrate, oversee, and assess ICT network infrastructures...

- Average Score: 3.06

- Response Distribution: Highly Relevant (6.25%), Relevant (37.50%), Moderately Relevant (25.00%), Slightly Relevant (18.75%), Not Relevant at all (12.50%)

- Key Insights: This skill has the lowest average score so far, with only 6.25% finding it highly relevant. This suggests network infrastructure management might be less critical compared to other skills.

Visualization: Bar chart showing response distribution.

5.3.6 Question 6: Master the skills necessary to design, establish, adjust, govern, and scrutinize ICT networks...

- Average Score: 2.94

- Response Distribution: Highly Relevant (9.38%), Relevant (21.88%), Moderately Relevant (34.38%), Slightly Relevant (21.88%), Not Relevant at all (12.50%)

- Key Insights: Similar to network infrastructure skills, network design and management receive a lower average score, suggesting they might be less crucial for everyone. However, a small but notable percentage (9.38%) still considers them highly relevant.

Visualization: Bar chart showing response distribution.

5.3.7 Question 7: Develop proficiency in producing, organizing, and structuring documents...

- Average Score: 3.25

- Response Distribution: Highly Relevant (12.5%), Relevant (37.50%), Moderately Relevant (18.75%), Slightly Relevant (25.00%), Not Relevant at all (6.25%)

- Key Insights: This skill falls in the middle ground of relevance, with most respondents finding it somewhat important. This suggests document creation and organization are likely part of various application developers jobs, but may not be a core focus for everyone.

Visualization: Bar chart showing response distribution.

5.3.8 Question 8: Enhance capabilities in setting up, customizing, evaluating, and resolving issues with computer hardware, software environments, and application systems...

- Average Score: 3.19

- Response Distribution: Highly Relevant (6.25%), Relevant (34.38%), Moderately Relevant (34.38%), Slightly Relevant (21.88%), Not Relevant at all (3.13%)

- Key Insights: This skill has moderate relevance with a larger group finding it relevant or moderately relevant (68.75%). This suggests troubleshooting and technical support needs might vary depending on individual projects, roles and/or organizations.

Visualization: Bar chart showing response distribution.

5.3.9 Question 9: Master the essential skills for operating system management...

- Average Score: 3.09

- Response Distribution: Highly Relevant (9.38%), Relevant (31.25%), Moderately Relevant (25.00%), Slightly Relevant (28.13%), Not Relevant at all (6.25%)

- Key Insights: Operating system management receives a moderate average score, suggesting its relevance might vary across roles, projects, or organizations.

5.3.10 Question 10: Acquire the ability to craft dynamic web pages with server-side programming...

- Average Score: 4.25

- Response Distribution: Highly Relevant (46.88%), Relevant (37.50%), Moderately Relevant (12.50%), Slightly Relevant (0.00%), Not Relevant at all (3.13%)

- Key Insights: Web development skills, particularly those involving server-side programming, remain highly relevant or relevant (84%), indicating their continued importance in building interactive web applications.

5.3.11 Ability to implement procedural program sequences using control structures, test cases, and debugging tools.

- Average Score: 4.06

- Response Distribution: Highly Relevant (34.38%), Relevant (43.75%), Moderately Relevant (15.63%), Slightly Relevant (6.25%), Not Relevant at all (0.00%)

- Key Insights: A strong majority (78.13%) rate this skill as highly relevant or relevant, indicating its importance in procedural programming and debugging.

5.3.12 Ability to design, implement, and test object-oriented programs based on specifications, adhering to standards and guidelines.

- Average Score: 4.16

- Response Distribution: Highly Relevant (46.88%), Relevant (31.25%), Moderately Relevant (12.50%), Slightly Relevant (9.38%), Not Relevant at all (0.00%)

- Key Insights: This skill is highly valued with a significant portion (78.13%) finding it highly relevant or relevant, underscoring the importance of object-oriented programming.

5.3.13 Ability to independently plan, execute, and document ICT tasks using appropriate techniques and problem-solving skills.

- Average Score: 4.25

- Response Distribution: Highly Relevant (46.88%), Relevant (37.50%), Moderately Relevant (9.38%), Slightly Relevant (6.25%), Not Relevant at all (0.00%)

- Key Insights: The high relevance placed on independent planning and execution in ICT tasks is evident, with 84.38% rating it relevant or highly relevant.

5.3.14 Analyze markets, economic principles, and financial indicators to make informed business decisions.

- Average Score: 2.88

- Response Distribution: Highly Relevant (3.13%), Relevant (34.38%), Moderately Relevant (21.88%), Slightly Relevant (28.13%), Not Relevant at all (12.50%)

- Key Insights: This skill shows a diverse range of relevance, suggesting it may be more situational or specific to certain roles within the industry.

5.3.15 Design and develop user interfaces that are visually appealing, user-friendly, and responsive to interactions.

- Average Score: 4.16

- Response Distribution: Highly Relevant (43.75%), Relevant (31.25%), Moderately Relevant (21.88%), Slightly Relevant (3.13%), Not Relevant at all (0.00%)

- Key Insights: The design and development of user interfaces are considered crucial, with 75% finding it highly relevant or relevant.

5.3.16 Independently plan, execute, and document automated tasks using scripts to streamline workflows.

- Average Score: 3.44

- Response Distribution: Highly Relevant (12.50%), Relevant (31.25%), Moderately Relevant (43.75%), Slightly Relevant (12.50%), Not Relevant at all (0.00%)

- Key Insights: There is a moderate to high relevance for scripting and automation in workflow management, with most respondents finding it at least moderately relevant.

5.3.17 Create clear, concise, and user-friendly guides and instructions for effective ICT resource usage.

- Average Score: 3.50

- Response Distribution: Highly Relevant (21.88%), Relevant (21.88%), Moderately Relevant (43.75%), Slightly Relevant (9.38%), Not Relevant at all (3.13%)

- Key Insights: The creation of user-friendly resources is generally seen as relevant, with a tendency towards moderate relevance.

5.3.18 Design, modify, and manage databases using SQL for efficient data storage, retrieval, and analysis.

- Average Score: 4.09

- Response Distribution: Highly Relevant (40.63%), Relevant (34.38%), Moderately Relevant (18.75%), Slightly Relevant (6.25%), Not Relevant at all (0.00%)

- Key Insights: SQL database management is highly regarded, with 75.01% rating it as relevant or highly relevant.

5.3.19 Analyze, document, and optimize business processes for improved clarity, efficiency, and effectiveness.

- Average Score: 3.53

- Response Distribution: Highly Relevant (18.75%), Relevant (43.75%), Moderately Relevant (15.63%), Slightly Relevant (15.63%), Not Relevant at all (6.25%)

- Key Insights: Business process optimization is relevant for many, but there's a spread across different levels of relevance.

5.3.20 Design and implement efficient data structures and algorithms to solve complex computational problems.

- Average Score: 4.16

- Response Distribution: Highly Relevant (46.88%), Relevant (28.13%), Moderately Relevant (18.75%), Slightly Relevant (6.25%), Not Relevant at all (0.00%)

- Key Insights: There is a strong emphasis on the ability to work with data structures and algorithms, seen as important by a majority.

5.3.21 Develop software iteratively and collaboratively using agile methodologies for increased adaptability and quality.

- Average Score: 4.63

- Response Distribution: Highly Relevant (71.88%), Relevant (18.75%), Moderately Relevant (9.38%), Slightly Relevant (0.00%), Not Relevant at all (0.00%)

- Key Insights: Agile methodologies are highly valued in software development, with a significant 90.63% considering it relevant or highly relevant.

5.3.22 Design and implement object-oriented software based on business requirements, utilizing concepts like classes, inheritance, and encapsulation.

- Average Score: 4.41

- Response Distribution: Highly Relevant (56.25%), Relevant (31.25%), Moderately Relevant (9.38%), Slightly Relevant (3.13%), Not Relevant at all (0.00%)

- Key Insights: Object-oriented principles are deemed essential, with a large majority (87.5%) finding them relevant or highly relevant for software design and implementation.

5.3.23 Develop and test object-oriented applications without inheritance, employing fundamental programming concepts.

- Average Score: 3.63

- Response Distribution: Highly Relevant (25.00%), Relevant (31.25%), Moderately Relevant (31.25%), Slightly Relevant (6.25%), Not Relevant at all (6.25%)

- Key Insights: This skill has varied relevance, suggesting it may depend on specific project requirements or programming paradigms in use.

5.3.24 Design and implement object-oriented applications with inheritance, utilizing advanced testing techniques for comprehensive quality assurance.

- Average Score: 4.19

- Response Distribution: Highly Relevant (40.63%), Relevant (40.63%), Moderately Relevant (15.63%), Slightly Relevant (3.13%), Not Relevant at all (0.00%)

- Key Insights: Advanced object-oriented programming and testing techniques are well-regarded, with 81.26% finding them relevant or highly relevant.

5.3.25 Design, develop, and test applications for microprocessors, understanding hardware-software interaction and resource constraints.

- Average Score: 2.97

- Response Distribution: Highly Relevant (12.50%), Relevant (21.88%), Moderately Relevant (25.00%), Slightly Relevant (31.25%), Not Relevant at all (9.38%)

- Key Insights: This skill appears more niche with a fairly even distribution across relevance categories, pointing to specialized areas of application.

5.3.26 Learn how to develop, legally establish, analyze, and implement entrepreneurial vision, covering everything from concept to final product.

- Average Score: 3.31

- Response Distribution: Highly Relevant (12.50%), Relevant (34.38%), Moderately Relevant (34.38%), Slightly Relevant (9.38%), Not Relevant at all (9.38%)

- Key Insights: Entrepreneurial skills have a mixed relevance, possibly reflecting the varying importance of these skills across different roles.

5.3.27 Develop web applications with a focus on functionality, security, and testing.

- Average Score: 4.28

- Response Distribution: Highly Relevant (53.13%), Relevant (31.25%), Moderately Relevant (9.38%), Slightly Relevant (3.13%), Not Relevant at all (3.13%)

- Key Insights: The development of secure and functional web applications is seen as a key skill by a majority (84.38%).

5.3.28 Integrate databases into web applications, ensuring security and data protection.

- Average Score: 4.34

- Response Distribution: Highly Relevant (53.13%), Relevant (34.38%), Moderately Relevant (9.38%), Slightly Relevant (0.00%), Not Relevant at all (3.13%)

- Key Insights: Database integration and security in web applications are highly relevant, which reflects the current focus on data security.

5.3.29 Design and implement data models to meet client needs.

- Average Score: 4.47

- Response Distribution: Highly Relevant (56.25%), Relevant (34.38%), Moderately Relevant (9.38%), Slightly Relevant (0.00%), Not Relevant at all (0.00%)

- Key Insights: Data modeling tailored to client requirements is highly valued, with 90.63% rating it relevant or highly relevant.

5.3.30 Develop and test mobile applications, considering device capabilities and limitations.

- Average Score: 3.63

- Response Distribution: Highly Relevant (28.13%), Relevant (31.25%), Moderately Relevant (25.00%), Slightly Relevant (6.25%), Not Relevant at all (9.38%)

- Key Insights: Mobile application development is relevant, with a notable distribution across the relevance spectrum, indicating its specific importance in certain contexts.

5.3.31 Customize e-business applications on the client, server, and database sides.

- Average Score: 3.44

- Response Distribution: Highly Relevant (25.00%), Relevant (25.00%), Moderately Relevant (31.25%), Slightly Relevant (6.25%), Not Relevant at all (12.50%)

- Key Insights: Customization of e-business applications shows a spread in relevance, indicating a specific need in certain sectors or roles within the industry.

5.3.32 Implement security measures in applications, including authentication, authorization, and auditing.

- Average Score: 4.44

- Response Distribution: Highly Relevant (65.63%), Relevant (18.75%), Moderately Relevant (12.50%), Slightly Relevant (0.00%), Not Relevant at all (3.13%)

- Key Insights: Security measures in application development are seen as highly important, with the majority (84.38%) rating it as relevant or highly relevant, emphasizing the current emphasis on cybersecurity.

5.3.33 Manage ICT projects effectively, from planning to execution to documentation.

- Average Score: 3.91

- Response Distribution: Highly Relevant (43.75%), Relevant (28.13%), Moderately Relevant (12.50%), Slightly Relevant (6.25%), Not Relevant at all (9.38%)

- Key Insights: ICT project management is generally considered relevant, though there's a notable portion that sees it as less relevant, which may reflect varied methodologies or scales of projects across organizations.

5.3.34 Design, implement, and test applications that support multiple users.

- Average Score: 4.44

- Response Distribution: Highly Relevant (59.38%), Relevant (25.00%), Moderately Relevant (15.63%), Slightly Relevant (0.00%), Not Relevant at all (0.00%)

- Key Insights: Multi-user application design is highly relevant to a majority, reflecting the common requirement for collaborative and multi-user environments in software.

5.4 Statistical Data Representation

To visually represent the survey findings, various graphs and charts were utilized:

- **Bar Charts:** Used to depict the distribution of responses for each skill and competency, showing the percentage of companies that rated each skill at different levels of relevance.

- **Pie Charts:** Employed to illustrate the overall importance of certain skill categories (e.g., technical vs. soft skills) as perceived by the industry.

- **Heat Maps:** Utilized to provide an at-a-glance view of the areas with the highest concentration of "Highly Relevant" ratings, facilitating the identification of key trends and priorities.

Insights from Additional Skills and Competencies

Participants were also given the opportunity to suggest additional skills and competencies not listed in the initial survey. Notable suggestions included:

- **Cybersecurity Awareness:** Highlighting the growing concern over data protection and system security within the industry.

- **Cloud Computing:** Reflecting the increasing reliance on cloud-based technologies and services for application development and deployment.

- **Continuous Learning:** Emphasizing the importance of ongoing education and adaptability in a rapidly evolving field.

These insights indicate emerging trends in the ICT sector and suggest areas for potential curriculum development to better prepare students for the demands of the industry.

Conclusion

The survey findings provide a comprehensive overview of the skills and competencies valued by the ICT sector, offering valuable guidance for the development of VET curricula in Kosovo and beyond. The additional skills suggested by participants point to the need for a forward-looking approach to education that incorporates emerging technologies and methodologies. This chapter lays the groundwork for targeted initiatives aimed at enhancing the alignment between ICT education and industry needs, thereby fostering a skilled and adaptable workforce capable of driving innovation and growth in the digital economy.

6   Discussion

The survey results underscore a significant emphasis on both technical and soft skills, with agile methodologies, object-oriented software design, data modeling, application security, and web development being rated as highly relevant. These competencies align with the global trend towards agile digital solutions and the need for robust, secure, and user-centric software. The high valuation of iterative development and user interface design indicates a shift towards more dynamic, user-focused approaches in software development, reflecting the industry's response to rapidly changing technological environments and user expectations.

Moderately relevant skills, such as project management, data characterization, and database architecture, suggest that while these areas are important, their relevance may be more contextual, depending on the specific role or project requirements. This variation points to the diverse skill sets needed in the ICT sector, where specialization and a broad understanding of related competencies can enhance an individual's adaptability and value within the industry.

The skills categorized as slightly relevant, such as network installation and management, market analysis, and e-business application customization, hint at the specialized nature of these competencies. Their lower average scores may reflect a more niche demand within the industry, potentially influenced by the company's size, market focus, or the specific nature of the services offered. This finding suggests the importance of a tailored educational approach that can adapt to these varying demands, equipping learners with a core set of highly relevant skills while also offering pathways to specialize in areas of emerging or niche interest.

Implications for ICT Education:

The alignment of VET curricula with the highlighted competencies is crucial for preparing a workforce capable of meeting current and future industry demands. Educational institutions, particularly those adopting or refining dual VET models, can leverage these insights to prioritize curriculum components that emphasize the highly relevant skills identified. Furthermore, the moderate and slight relevance of other skills underscores the need for flexible, modular educational frameworks that can be customized to individual career paths or evolving industry needs.

7 Recommendations

Drawing from a comparative analysis of the DUAL VET systems in the D-A-CH region and a survey conducted with 32 ICT companies, including international insights, this chapter offers key recommendations to align VET with industry needs, especially in coding and application development. These suggestions aim to improve graduates' employability by equipping them with highly valued competencies, reflecting best practices from the D-A-CH region's successful integration of workplace learning and vocational education.

1. Curriculum Development and Update:

- **Incorporate Agile Methodologies**: Given the high relevance of agile methodologies, VET programs should integrate practical training in agile project management, iterative development, and collaborative working environments to reflect current industry practices.

- **Emphasize Object-Oriented Design and Data Modeling**: Courses should provide in-depth coverage of object-oriented programming principles, design patterns, and data modeling techniques to meet the strong demand for these skills in application development roles.

- **Strengthen Application Security Competencies**: With the increasing importance of cybersecurity, embedding security principles and practices into the curriculum is critical for preparing students to develop secure applications.

2. Industry Collaboration:

- **Enhance Industry Partnerships**: Establish or strengthen partnerships with ICT companies to ensure that VET programs remain responsive to the evolving needs of the industry. This could include guest lectures, industry placements, and project sponsorships.

- **Feedback Loops**: Create mechanisms for ongoing feedback from industry partners to continually update and refine curriculum content based on real-world requirements and technological advancements.

3. Specialization and Flexibility:

- **Modular Curriculum Design**: Develop a modular curriculum that allows students to specialize in areas of high demand, such as web development, user interface design, and database management, while still covering a broad base of foundational ICT skills.

- **Adaptability to Niche Skills**: Offer elective modules or short courses on slightly relevant but niche skills, such as network management or e-business applications, to cater to diverse student interests and emerging industry trends.

4. Soft Skills Integration:

- **Integrate Soft Skills Training**: Beyond technical competencies, incorporate soft skills such as teamwork, communication, and problem-solving into the curriculum, reflecting their importance in the ICT profession.

5. Continuous Professional Development:

- **Lifelong Learning Opportunities**: Encourage continuous professional development by offering advanced courses, certifications, and workshops for graduates and industry professionals to update their skills in line with technological advancements.

6. Research and Innovation:

- **Encourage Applied Research**: Foster a culture of innovation and applied research within VET institutions, enabling students and faculty to engage in projects that address real-world challenges and contribute to the ICT sector's advancement.

7. Policy and Funding Support:

- **Advocate for Policy Support**: Engage with policymakers to ensure that VET programs in ICT are adequately supported, funded, and recognized within the national education and workforce development strategies.

- **Invest in Modern Infrastructure**: Secure investment for state-of-the-art facilities and resources, including software development tools, laboratories, and collaborative spaces, to provide a conducive learning environment.

By implementing these recommendations, VET institutions can better prepare their students for successful careers in the ICT sector, ensuring that the workforce is equipped with the skills and competencies that are most in demand in the digital economy.

8   Conclusion

The conclusion of this study emphasizes the critical alignment between vocational education and training (VET) and the evolving needs of the ICT sector, particularly in application development roles. Incorporating insights from a survey with 32 companies and a comparative analysis of the D-A-CH region's DUAL VET systems, the research underscores the importance of integrating practical, industry-relevant competencies into the VET curriculum. This approach not only enhances graduate employability but also ensures the workforce is adept at navigating the contemporary digital landscape.

9 Appendices

9.1 References

Bibliography of sources consulted for the comparative analysis of DUAL VET systems:

1. **ESCO Portal**: This is the main page for the European classification of Skills, Competences, Qualifications and Occupations. ESCO is part of the Europe 2020 strategy and aims to enhance job mobility and integration within the EU labor market by providing a standardized terminology for skills, competences, and occupations. Link: ESCO Portal

2. **ESCO Skills and Competences**: This section of the ESCO portal provides detailed information on the skills and competences classified within the ESCO framework. It includes a broad range of skills from transversal to occupation-specific ones, all structured hierarchically. Link: Skills & Competences | Esco

3. **O*NET (Occupational Information Network), O*NET OnLine**: O*NET provides a comprehensive database of worker attributes and job characteristics. As the U.S. Department of Labor/Employment and Training Administration's primary source of occupational information, O*NET is a valuable resource for understanding the skills and competencies required for various occupations in the U.S. Link: O*NET OnLine

4. Euler, D. (2013). "Germany's dual vocational training system: a model for other countries?" *Friedrich Ebert Stiftung*.

5. Rauner, F., & Smith, E. (2010). "Rediscovering Apprenticeship: Research Findings of the International Network on Innovative Apprenticeship (INAP)." *Springer*.

6. Gonon, P. (2009). "The Quest for Modern Vocational Education – Georg Kerschensteiner between Dewey, Weber and Simmel." *Peter Lang AG*.

7. Stalder, B. E., & Nägele, C. (2011). "Vocational education and training in Switzerland: Organisation, development and challenges for the future." *VET Boost: Towards a Continuing Education and Training (CET) system in Switzerland, 9-36*.

8. Billett, S. (2011). "Vocational education: Purposes, traditions and prospects." *Springer Science & Business Media*.

9. ICT Berufsbildung Schweiz. (2020). "ICT Professional Education and Training in Switzerland: Creating Competencies for the Digital Future."

10. Gonon, P., & Maurer, M. (2012). "The Dual System of Vocational Education and Training in Switzerland: What Can Be Learnt About the Role of Policy in Shaping Education?"

11. Schweri, J., & Müller, B. (2008). "Does the Dual System Improve the Match Between Education and Employment

12. Wettstein, E., & Gonon, P. (2009). "Switzerland: Keeping the Vocational Education and Training System Flexible

13. Strahm, R. H. (2014). "Why Switzerland Has the Best Vocational Education and Training System in the World."