ChemSkills

Enabling the green and digital skills transformation of the chemical industry.

Report on ChemSkills Survey Results

1st iteration, generic results

January 2025

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Executive summary

This report is part of the ChemSkills project, aiming to assess the evolving trends in the chemical industry and their impact on skills and workforce requirements. The survey was conducted by the project consortium between February and October 2024, targeting key stakeholders to gather insights on sectoral needs and offer to meet green and digital transition and gaps found in five sectors: Plastics, Consumer Chemicals, Fertilisers, Rubber, Pharmaceuticals and Petrochemicals.

The findings of the survey show that the responding organisations are experiencing significant changes driven by a focus on **sustainability and circular economy practices**, **regulatory compliance**, and the adoption of **digital technologies**. These trends align with broader global challenges, such as climate change and the need for innovation in production processes. In contrast, automation and robotics and personalisation are identified as less critical trends, potentially due to the sector's focus on large-scale operations and efficiency over product customisation.

The report underscores the pressing need for upskilling and reskilling the workforce to address these changes. **Sustainability, data analytics**, and **cybersecurity** are viewed as the most critical digital competences. These priorities reflect current global trends in addressing environmental concerns, leveraging data-driven strategies, and ensuring secure digital operations. The data suggests that generational differences in digital skills are widely acknowledged, with the majority (91.3%) identifying at least a minor gap. While most see this as a minor issue, a notable 39.13% regard it as significant, indicating a potential challenge for organisations in leveraging digital tools effectively across all age groups. As responses show, the gender-based differences in digital skills are not widely perceived as a significant issue in most organisations,

Safety-related competences and core technical competences such as **Chemical Process Design** and **Material Science** dominate as essential sector skills, reflecting their critical role in advancing industrial and chemical processes. **Quality Control** and **Instrumentation** are also highly rated, showing the sector's focus on maintaining standards and leveraging technology for process optimization. The results of the survey show that workforce-related challenges both the availability of skilled workers and the availability of training programs are the most urgent needs for the respondents.

This report serves as a foundation for future work to further support the sector’s adaptation to the emerging trends. The following run of the survey is planned focused on deeper insight in above mentioned sectors.

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1. Identification of Respondents

This section provides detailed information on the respondents who completed the survey (119), including the type of organisation where they operate, position in the value chain, size, market reference, country and area of operation.

1.1 Type of organisation and position in the segment

The pie chart shows that the largest share of all respondents belongs to the "Industry and SMEs" category together with Industry Associations, which represents more than 70% of the total answers. The second main group is "Education and Training Provider – VET &Associations", which accounts for 12% of the answers. The third main sector is "Public institutions and Authorities", which represents 5% of the answers. "Social Partners" such as trade unions, unions of industrial and employers' associations accounts for 4% of the answers, followed by "Regions and municipalities" which both stand at 3%. The category "Other" was represented by 5% of the respondents. The share was the same as for the "Public institutions and Authorities" and in this category was recorded an answer from a landowner.

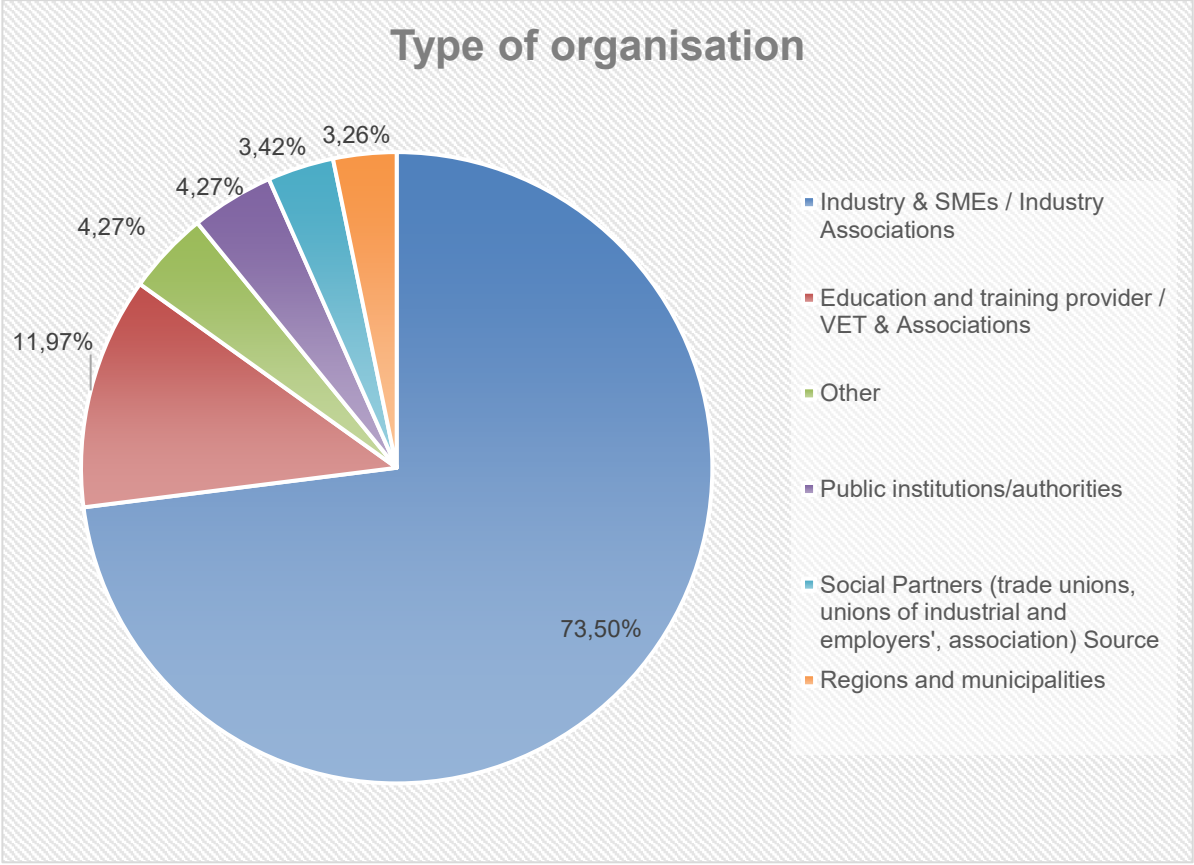

Figure 1: Type of organisation

When it comes to the position of respondents, the analysis of the responses shows that most participants are from Plastics and Petrochemicals which both stand at 25% followed by the category "Other" including sectors of batteries, lobbying, metallurgy, painting and coating and construction chemicals. The third main category is the segment of Fertilisers and Agriculture which represents 10% of the total answers. Consumer Chemicals, as well as Rubber represent

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more than 9% of the total answers. The pharmaceuticals segment accounts for nearly 7% of the total.

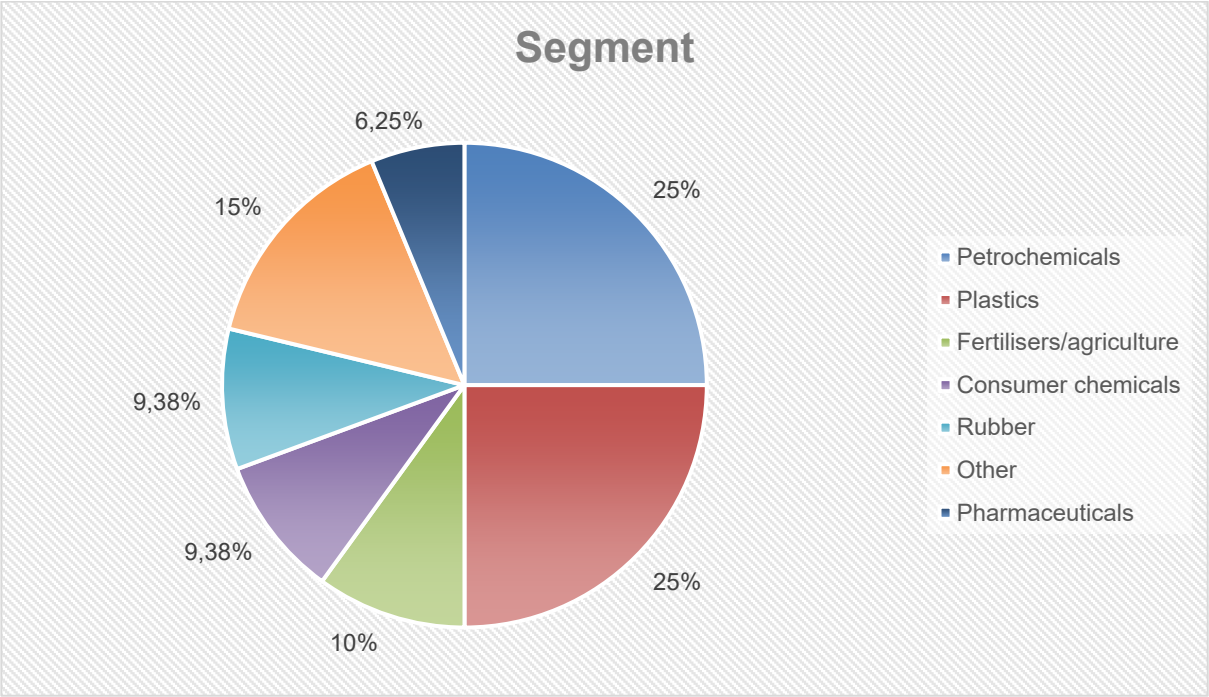

Figure 2: Type of segments

1.2 Size and country of operation

With regards to the size of the organisations, most respondents represent large organisations (nearly 60%), with a headcount of over 250 employees. The second largest share of respondents is associated with medium-sized organisations, representing almost 20% of the total. Finally, 13.6% of the survey participants represent micro-organisations, and 7.69% small organisations.

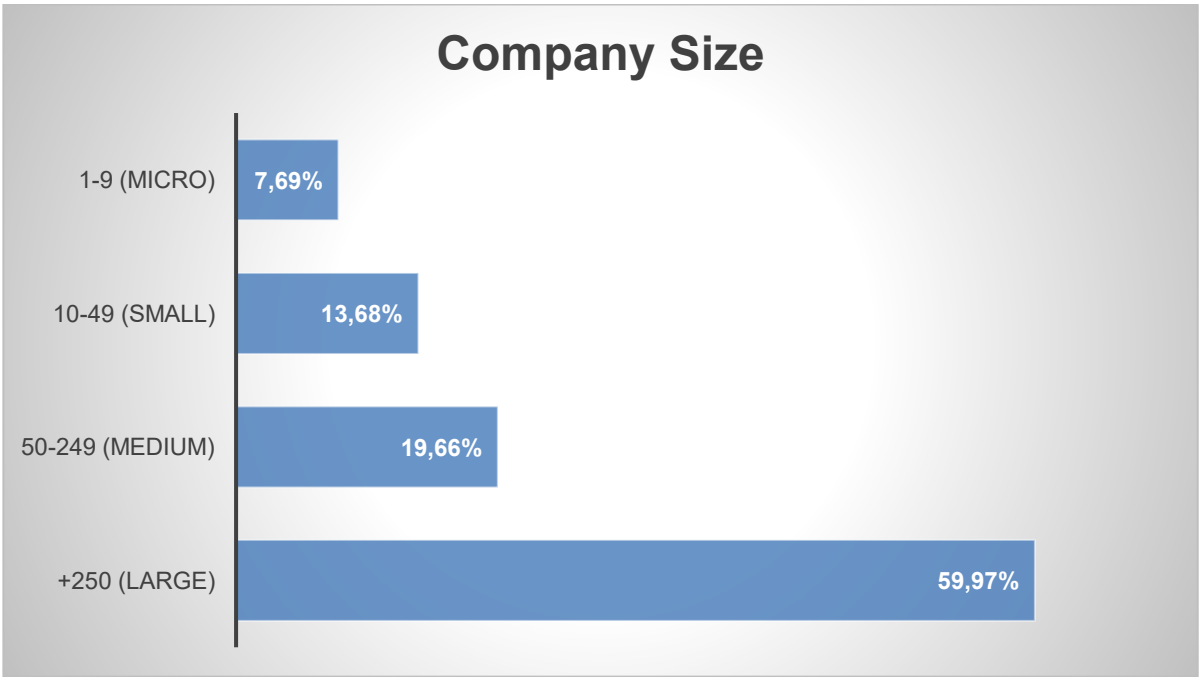

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Figure 3: Size of organisations

The respondents were asked to indicate the area of operation of their organisation, both in broad terms worldwide and in individual EU countries. The respondents of the survey, whose organisations operate in the European Union, were asked to specify the individual countries; some of the organisations operate in multiple countries in the European Union. The largest share of organisation participating in the survey indicated that they operate in Germany (46 respondents) and the Netherlands (respondents), followed by Belgium (37 respondents), Italy (31 respondents), Spain (31 respondents) and France (31 respondents), then Czechia (27 respondents), Austria (25 respondents), Slovenia (23 respondents), Sweden (21 respondents), Croatia (20 respondents), Finland (19 respondents), Hungary, Poland, Romania, Slovak Republic (18 respondents in each mentioned country), Denmark and Portugal (14 respondents in each), Bulgaria, Estonia and Ireland (10 respondents), Greece 9 respondents, Latvia, Lithuania and Luxembourg 8 respondents per each country and finally, Cyprus and Malta with 5 respondents. One-third of respondents also indicate that their organisation operates worldwide, in non-EU countries such as United Kingdom, Switzerland, Ukraine, Norway, Belarus, Serbia, Bosnia, Kazakhstan then in USA, Turkey, Oman, Tunisia, Brazil, China and Singapore.

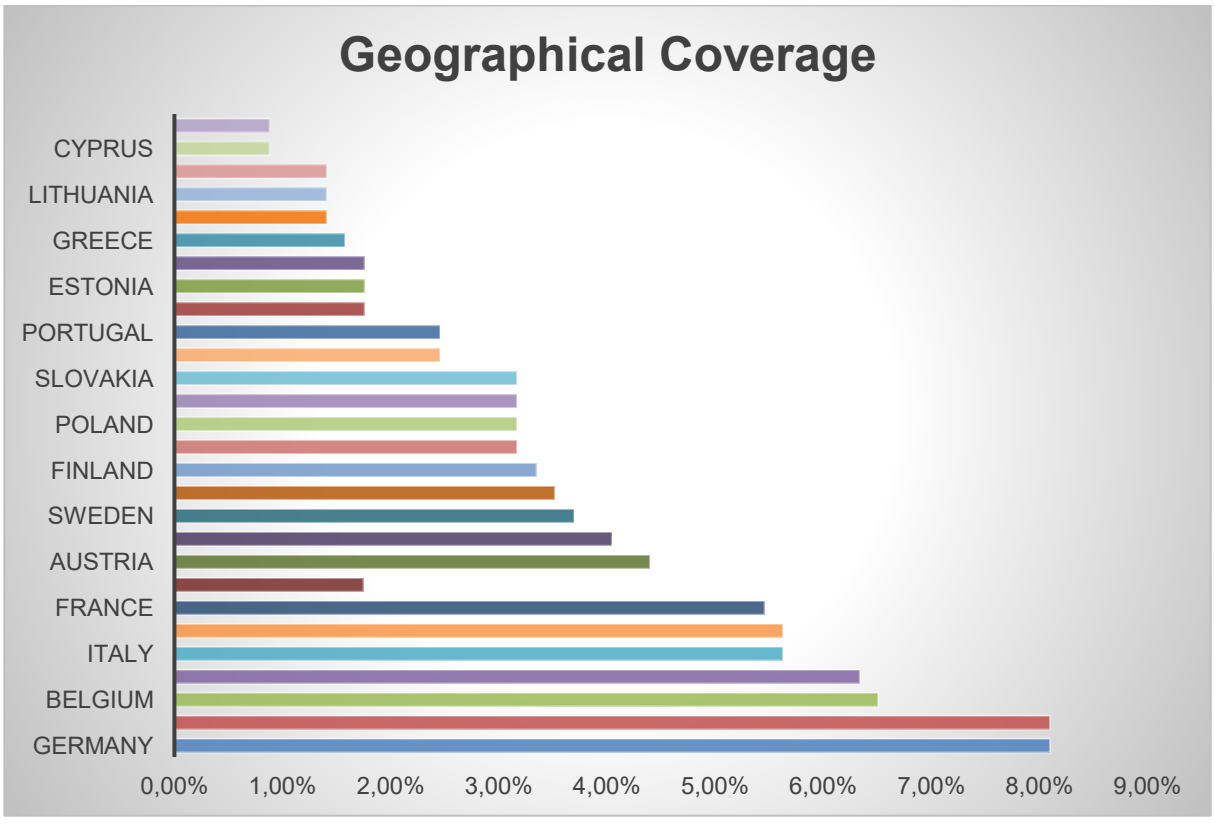

Figure 4: Geographical Coverage

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2. Sectoral Needs to Meet Green & Digital Transition

This section provides an in-depth analysis of macro topics and related sub-categories which have been identified as the main trends of. The largest share of respondents (36%) sees the "Growing Emphasis on Sustainability and Circular Economy"- as the most significant trend in the whole chemical ecosystem. It is followed by the trend "Regulatory Changes Impacting Industry Practices"- indicated by 28 % of respondents. The third identified trend is "Increased Adoption of Digital Technologies which represents 24%. Finally, the trend "Shift Towards Automation and Robotics" is specified as the fourth significant trend (9%) and Rising demand for personalised and customised products accounts for up to 3% of respondents. Four respondents indicated "Other" trends, and they also emphasised "Social Aspects". They see the changing trade flows with imports from Asia as very important and consider "Cost Competitiveness in Europe" to be very challenging. The respondents rate on a scale from 1 to 5 how likely their department/organisation/sector is to be affected by the upcoming change. The green influence is rated as 4.54 and the digital influence is expected at the level of 3.70.

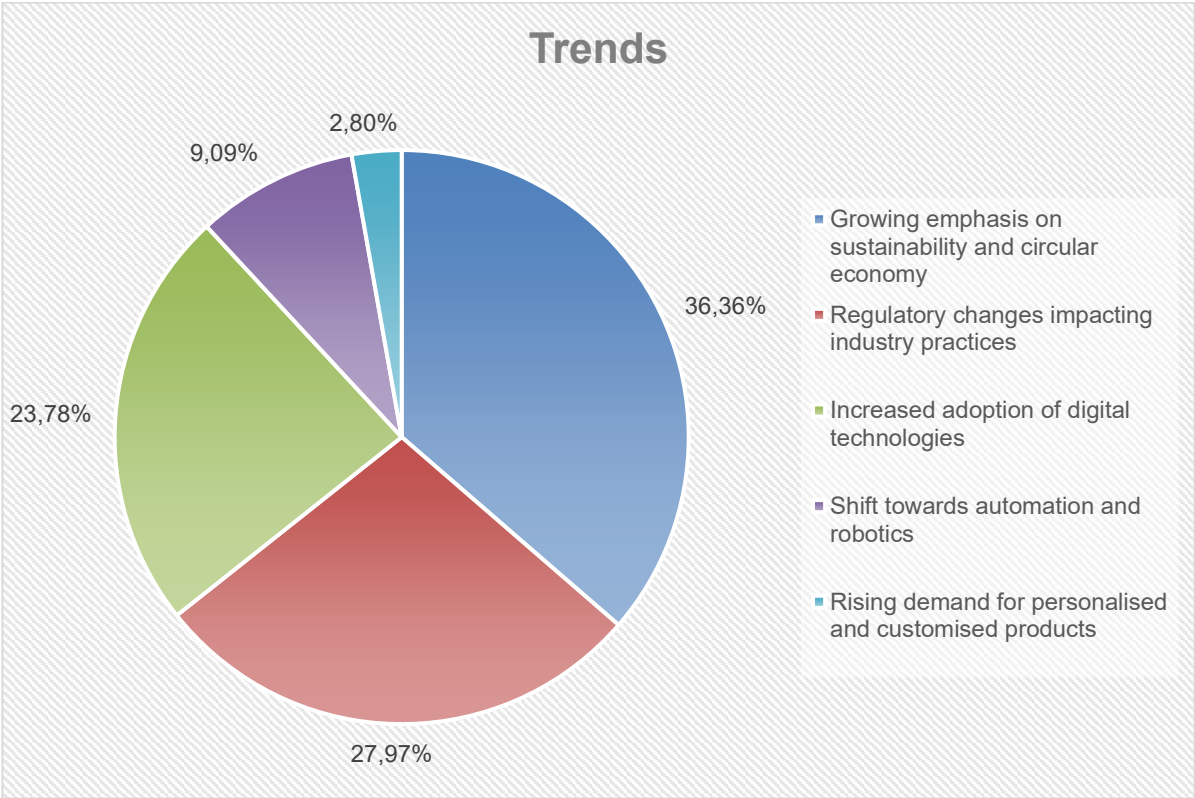

Figure 5: Current trends/drivers of change that the respondents experience in the current market

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3. Competences needed in Chemistry

This section provides an analysis of skills and knowledge needed in the sector. A range of competence categories was given, and respondents rated the specified competences. In the category "Other" the respondents could express their skills and knowledge not included in the range.

3.1 Sectoral

Regarding specific competences for the chemical industry, the respondents indicated which specific competences in terms of skills and knowledge are needed from the range depicted in the figure below. They rated the competence on a scale from 1 to 5 (1: least important, 5: most important). The skills and knowledge on safety, risks and quality reached the highest rate above 4. High rate also had skills on "Chemical Processes" and disciplines such as "Instrumentation" and "Material Science". Skill and knowledge of "Heat Transfer" are considered to have a medium importance for the overall sector. "Reaction Engineering" reached rate below 3. The knowledge of "Metallurgy" has been shown as negligible. However, in the comments some respondents highlight that all the mentioned skills and knowledge is required with high importance. The current chemical such as beta disciplines remain important and should not be neglected.

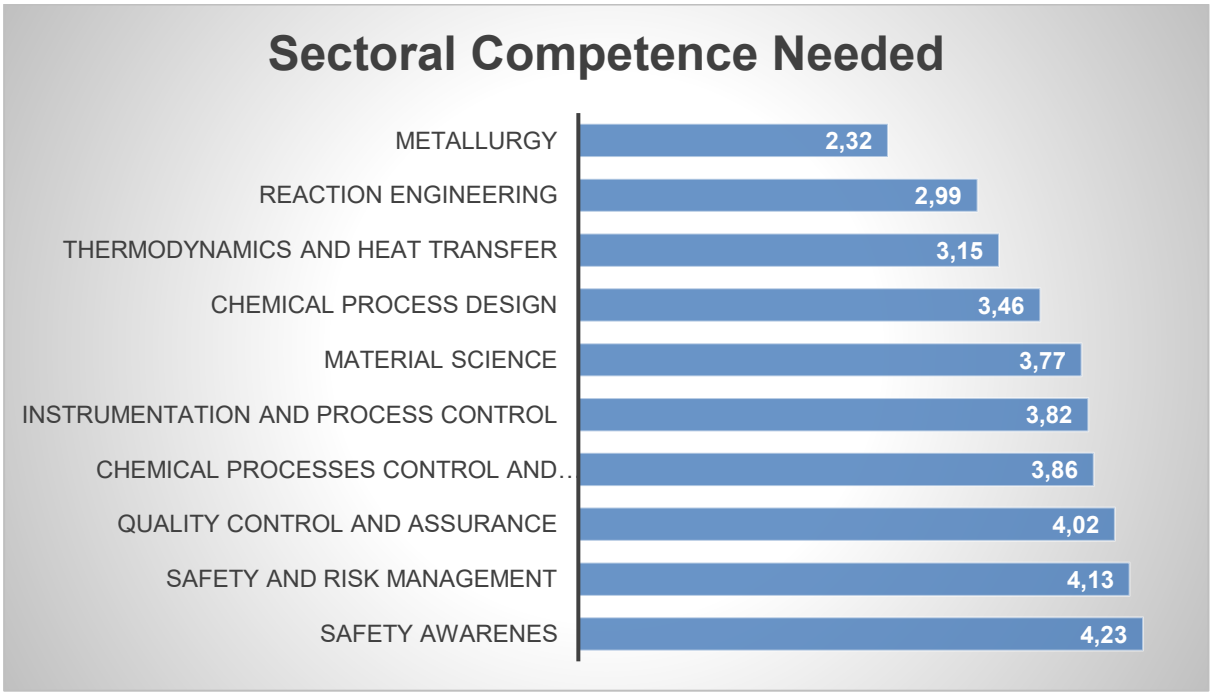

Figure 6: Sectoral Competence Needed

3.2 Digital

Digitalisation is transforming the chemical industry by utilising technologies such as digital twins, simulation, virtual and augmented reality (VR and AR). As the sector embraces these advancements, it presents both substantial strengths and notable challenges. The following section investigates the skills and knowledge needed for the digital transition of the chemical industry. Based on the DigiComp Framework, several skills and knowledge were specified so

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that the respondents could rate them (Figure 7). The digital skills for sustainability and circular economy expertise are rated as the highest need (rate 4.41) followed by "Data Analytics" (4.13). The competence in "3D printing and manufacturing" does not reach medium importance and is rated below 3. Besides the specified digital skills and knowledge, the respondents mention in the category "Other" also knowledge of Statistics, SAP Systems and Chemical Regulatory Database.

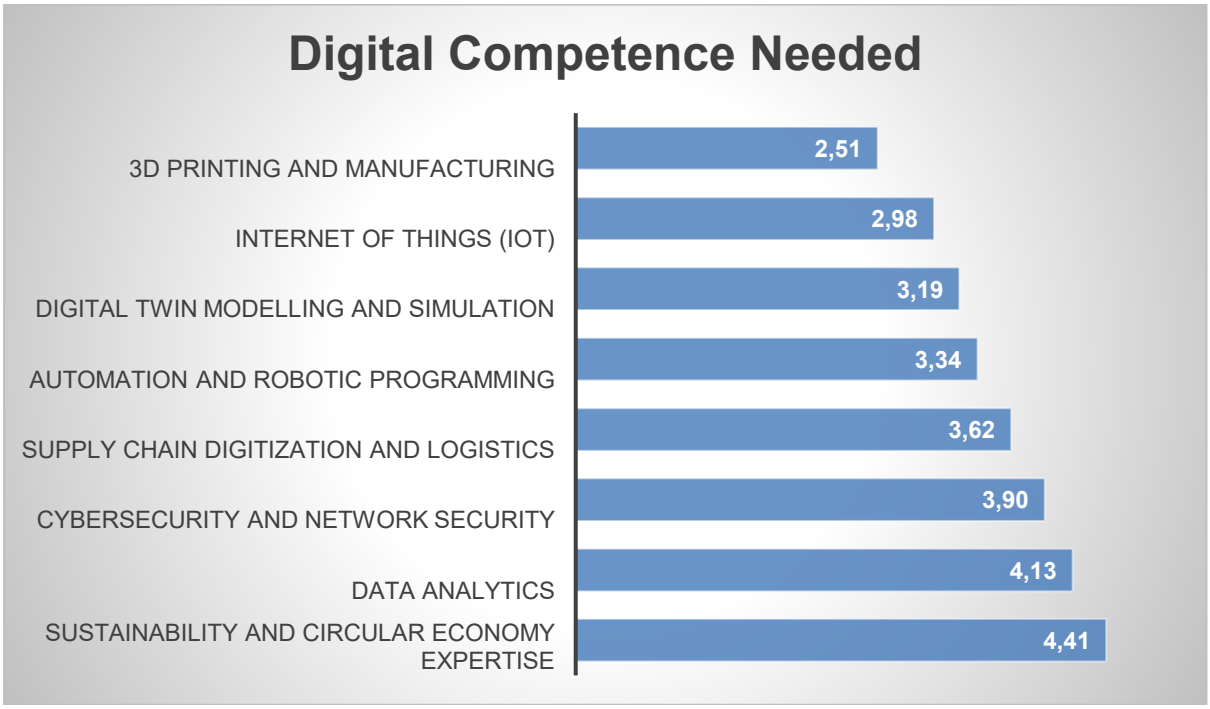

Figure 7: Digital Competence Needed

3.3 Soft

Soft competences are often undervalued, but they have been shown to be more and more important. Some respondents mentioned special comments on their importance. Innovation and teamwork were highlighted to be crucial soft skills, as well as the close linking of learning and innovating. Also, the idea of the creation of learning communities between companies and knowledge institutes arose. The overall results on soft competence needed are summed in the following figure and confirms their importance. Half of the mentioned skills reach a high rate, and no skill is rated below 3.

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Figure 8: Soft Competence Needed

3.4 Green

The green competences were defined for the survey based on the GreenComp Framework. Sustainability and the circular economy were highlighted as the most important trend. Four of five categories are rated above 4. The respondents see "Embodying sustainability values" (4.31 rate) as the priority, followed by "Acting for Sustainability" (4.19), categories of "Energy efficiency focus" and "Monitoring and predicting Environmental Impact" on the same level 4.13.

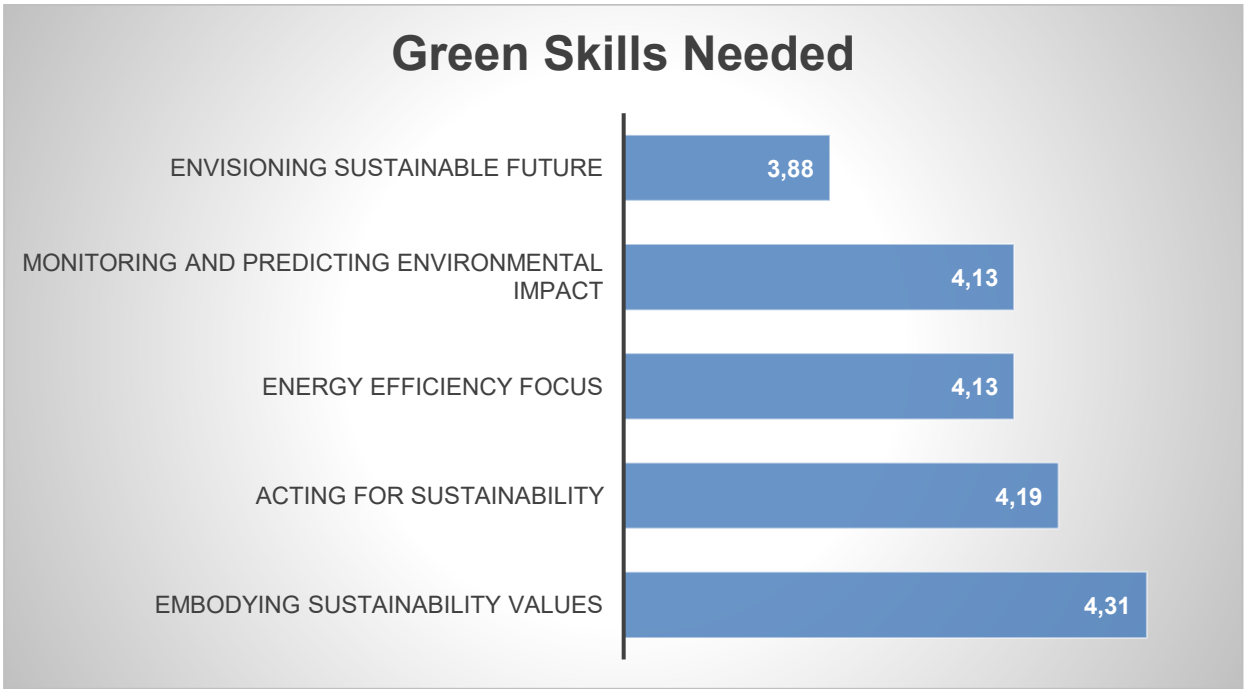

Figure 9: Green Competence Needed

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4. Workforce needed in chemical industry

The survey included a section on the workforce needed to analyse immediate and long-term needs/challenges for the department/organisation/sector. The immediate challenge was defined for 1-2 years; meanwhile, the long-term one for 5-10 years. The respondents rated the importance of each suggested challenge on a scale from 1 to 5. They also used the same system to define which workforce in terms of job positions is needed in the sector. These were the suggested following positions:

- Elementary workforce (simple and routine tasks which may require the use of hand-held tools and considerable physical effort)
- Operators (operate and monitor industrial and agricultural machinery and equipment on the spot or by remote control; drive and operate trains, motor vehicles and mobile machinery and equipment)
- Workers (apply specific technical and practical knowledge and skills to construct and maintain products, processes, services)
- Assemblers (assemble products from component parts according to strict specifications and procedures)
- Technicians (perform technical and related tasks connected with research and the application of scientific or artistic concepts and operational methods, and government or business regulations)
- Professionals (increase the existing stock of knowledge; apply scientific or artistic concepts and theories; teach about the foregoing in a systematic manner; or engage in any combination of these activities)
- Managers (plan, direct, coordinate and evaluate the overall activities of enterprises, governments, and other organisations, or of organisational units within them, and formulate and review their policies, laws, rules and regulations)

4.1 Immediate need/challenge

As an immediate need, “Availability of workforce with the appropriate skills” was identified. It was rated the highest (4.17) in importance, suggesting that finding skilled workers is the most critical immediate challenge that respondents are facing. The challenge seems to become more urgent in the future as the European population across EU countries is getting older. The graph identifying long-term needs confirms that respondents are worried about the trend of workforce shortages driven by demographic change. In the long-term perspective, this need was rated even higher with a rate of 4.30. Slightly less important than the workforce availability but still rated highly is the “Availability of training programs” (3.91). This indicates that the lack of training programs is seen as a significant barrier to addressing skill shortages and confirms the importance of the ChemSkills project. “Initial investment costs” are a concern; they are not perceived as the most pressing challenge compared to workforce-related issues. This need was rated with 3.74. Similar in importance to initial investment costs is the need for “Integration issues with existing systems” (3.61). This suggests that while integration challenges are recognised, they are not as immediate or pressing as workforce availability and training programs.

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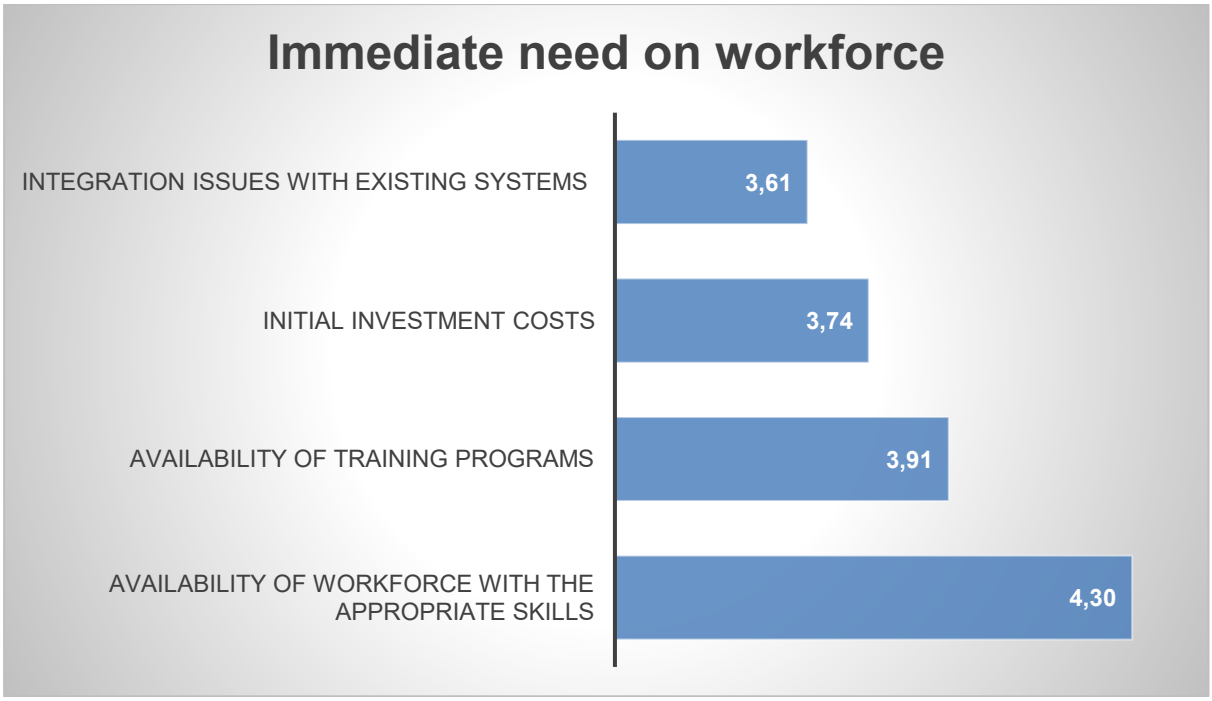

Figure 10: immediate need/challenge for the department/organisation/sector

When analysing specific job positions immediately needed, the most needed are "Professionals" supposed to increase the existing stock of knowledge; apply scientific or artistic concepts and theories; teach about the foregoing in a systematic manner; or engage in any combination of these activities. The workforce in this position was rated on a scale from 1 to 5, with 4.18, and was prioritised to "Technicians" (3.93) and "Workers" (3.48) on the same level as "Operators" (3.46) or "Managers" (3.39). "Elementary workforce" carried out simple and routine tasks, "Assemblers" just following strict specifications and procedures were behind the previously mentioned categories, with rates 2.77, respectively, 2.13. Additionally, the respondents identified as a crucial workforce with dedicated knowledge on new technologies and the market. High-skilled technicians and professional experts were found as key ones as other workforce categories can be found more easily.

4.2 Long-term need/challenge

In the longer term (5–10 years), the "Availability of workforce with the appropriate skills" (is still the most pressing need with a rate 4.38, reflecting the enduring nature of skills shortages in the organisation or sector. The continued high importance of "Availability of training programs" (3.74) highlights the necessity of investing in upskilling efforts to address this challenge over time. Additionally, "Initial investment costs" (3.62) and "Integration issues with existing systems" (3.53) are consistently recognised as important concerns, suggesting that while workforce and training needs take precedence, the sector also anticipates ongoing financial and technological challenges in implementing long-term solutions.

Concerning job positions, the results were found to be identical to the findings for immediate needs. Again, Professionals are identified as the most required (with the rate 4.22) followed by Technicians (3.96), Workers (3.46), Managers (3.44), Operators (3.41) and Elementary workforce (2.72) together with Assemblers (2.46) behind. Among specified job roles, Scientist, Data Analysts, Regulatory Experts, Sustainability Certification Experts were identified.

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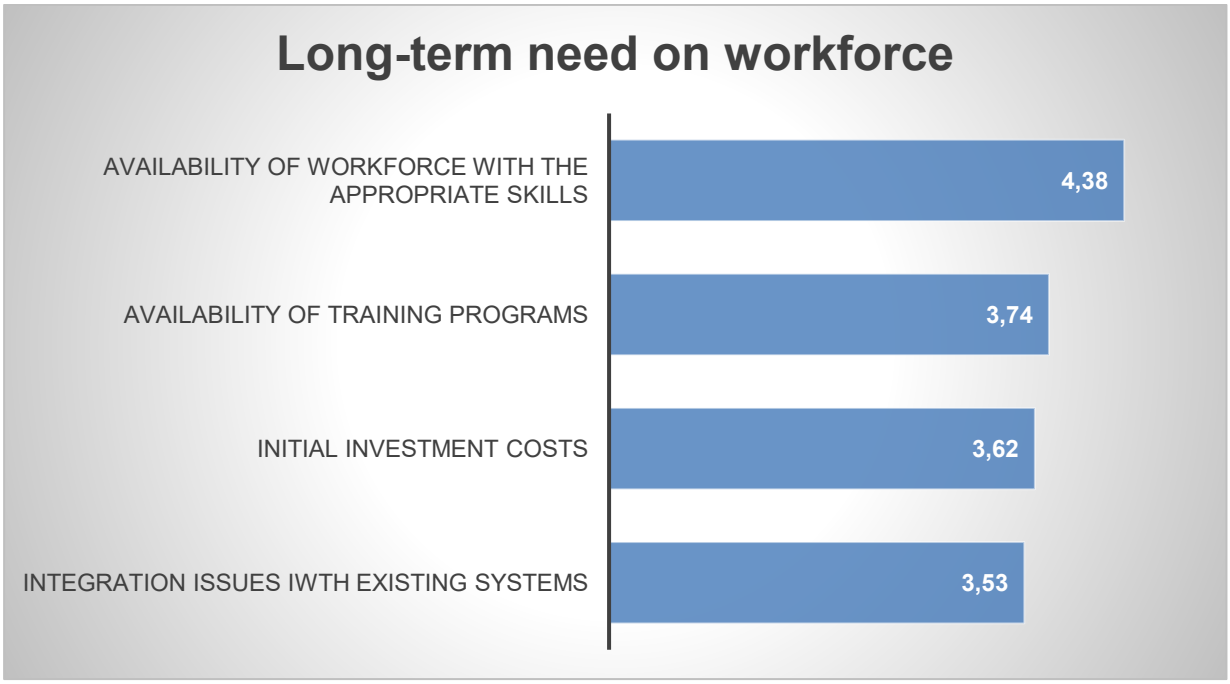

Figure 11: long-term need/challenge for the department/organisation/sector

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5. Training Needs in the Transition

Questions on the Offer were also included in the survey. In the survey of the first iteration, they were focused on analysing the current situations with training and education and what is needed for future industry transition.

5.1. Training and courses in the chemical industry

The pie chart illustrates responses to the question of whether departments or organisations are already applying any training courses. The chart reveals that a substantial percentage of organisations in light blue (46.15%) are already proactive in implementing training courses, which aligns with the earlier data showing a significant focus on workforce skills and training. However, the nearly equal proportion of organisations (38.46%) that have not yet implemented training courses highlights a gap that could potentially slow down workforce development efforts. The 10.26% of respondents plan to implement courses, which shows some optimism for increased training activities, though it also suggests that these organisations need time and resources to act. The small group in the purple line (5.13%) with no plans for training reflects limited interest or capability to prioritise this area, possibly requiring external support or incentives.

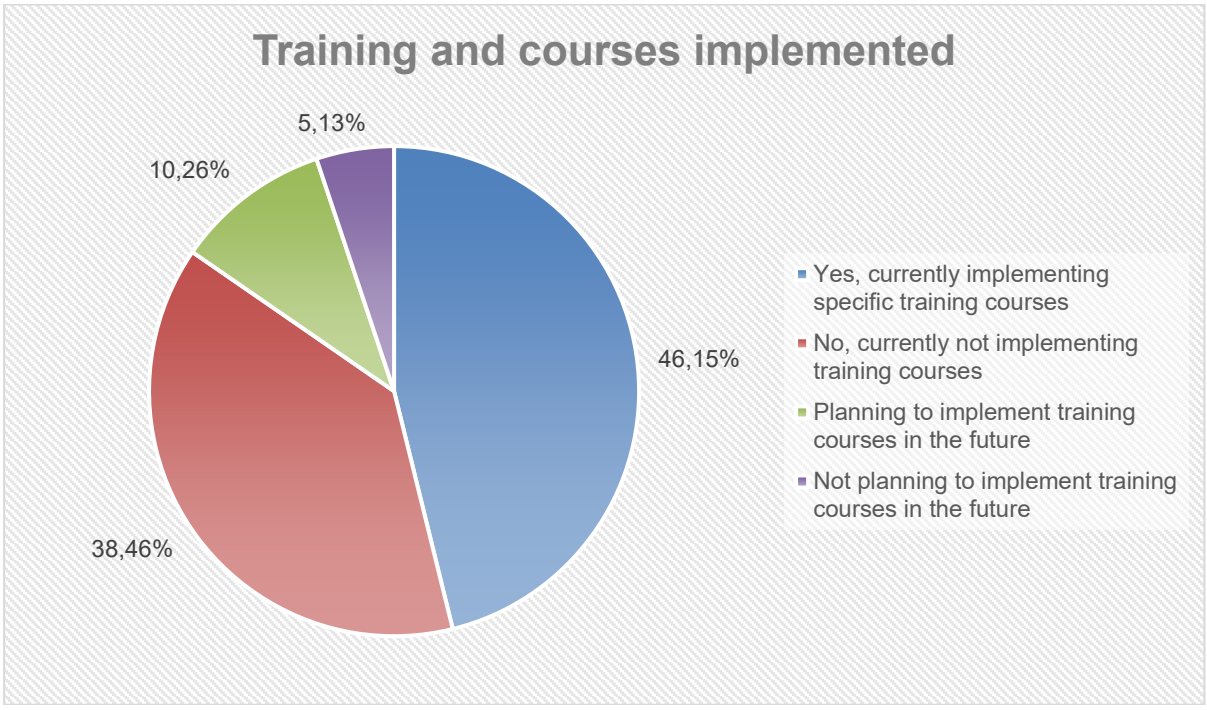

Figure 12: Training and courses already implemented in the department/sector/organisation

14.53% of respondents acknowledge the existence of strategic documents related to new skills. They provided the following links (Table 1):

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Table 1: Strategic documents related to required new skills in your sector

https://nordicengineers.org/2022/09/do-we-have-the-skills-to-deliver-the-green-transition/
https://innet.vsb.cz/cs/dokumenty
https://digitalisjoletprogram.hu/hu/tartalom/das-magyarorszag-digitalis-agrar-strategiaja
https://publications.jrc.ec.europa.eu/repository/handle/JRC138035
https://app.sazp.sk/
https://www.siemens.com/global/en/products/automation/industry-software/simit.html
https://hsc-chemistry.com/hscchemistry
https://engineersfinland.insinoori.fi/julkaisut-sps-publications/

However, a significant portion (35.04%) explicitly states that no such documents are available, highlighting a gap in strategic planning for addressing emerging skill needs. Over half of the respondents (50.43%) are unaware of whether such documents exist, signalling a need for improved dissemination and visibility of these resources.

Some respondents mentioned the training and courses implemented for future industry transition in the departments (Table 2).

Table 2: Training and courses already applied for future transition

Bioresource business development and management
Business models for sustainable energy
Internal Academy: Circular economy,
Digital Academy: Quantum cryptography
Building a training centre for the battery cell production and process training
Communication of new trends in the area of capitalization of carbon sequestration
Bio based economy
Sustainability and reporting
Training courses about bio-mass balance approach
Understanding of PCF calculations, regulatory requirements
Digital Trainee Programme for future process, asset, maintenance managers
Continuous training on new digi technologies
ISCC training
Training for ESRS standards
„Enterprise resource planning“
Study programme Agriculture 4.0 (focused on modern technologies, robots, digitalisation, precise agriculture...)
Digitalization
Courses on sustainability of elastomers/thermoplastics
Mandatory sustainability course for apprentices
Lectures on sustainability has been provided in courses
Building nature
Rubber technology Seminar
Courses on fertilizers and courses on how to not use fertilizers are being followed.
Precise farming, Nitrate directive, animal welfare, greening, ecological farming
Sustainability Master, Artificial intelligence
Planning to implement training courses in the future
Data literacy

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5.2 Investment in personal learning and development

The organisations implementing the training and courses in the department, mostly invest 20-80 hours per person per year, on average, 33% of respondents spend less than 20 hours and on the contrary, 19% invest more than 80 hours per person per year. 24% of respondents did not know. The most significant share of training is invested by micro companies. 25% of them invest more than 80 hours per year. In comparison with large companies with more than 250 employees, this share is 5% higher. In comparison with medium-sized companies with employees from 50-250, the micro companies invest 12% more. Among the different groups, education and training providers demonstrate the highest levels of time investment in up-skilling. Just 10% of the industry provide more than 80 hours per person per year. The least information about the time invested into personal learning and development is from Regions and municipalities as 67% of them indicated the answer "I do not know". It was similar to the question on the percentage of investment allocated to learning as part of the development budget. The largest portion of respondents is unaware of how much their organisations invest in learning and development comprising 39.32% of responses. This points to a lack of transparency or awareness about budget allocation. The second largest category, making up 39% of responses, indicates that many organisations are allocating less than 20% of the total employee development budget. Only a modest number of organisations (representing 12.82% of responses) are moderately prioritizing learning and spend around 30% of it. The highly prioritizing workforce skill-building through significant investment is rare, just 7.69% of responses confirm high investment 40% or more.

Organisations that are not currently implementing training or planning to do so (43.46% + 5.13%) represent a critical target for interventions, such as resource allocation, policy support, or awareness campaigns. Encouraging these groups to prioritize training will help bridge workforce skill gaps and meet both immediate and long-term organisational needs.

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6. Gender Gaps

The survey includes a section on gaps. In this run of the survey, the gaps are focused on gaps in digital skills in view of the age and gender. The following pie charts illustrate the responses to whether there is a generational gap and gender differences in digital skills among employees in organisations.

The respondents are split into two groups; 57% believe that there is a generational gap in digital skills, but it is minor. The second one (34%) sees a significant generational gap in digital skills. No generational gap in digital skills is seen by only a small percentage of respondents (10.26%).

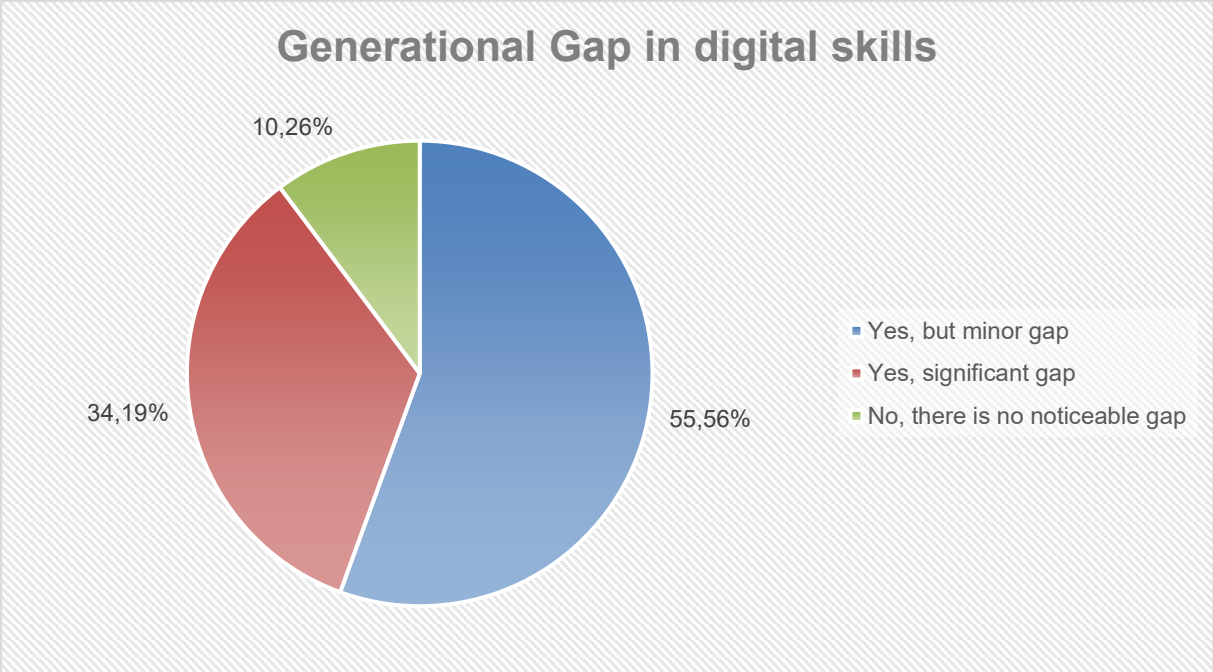

Figure 13: Generational gap in digital skills among employees in the organisations

For organisations where significant gaps are observed, prioritise digital transformation strategies and provide targeted support to reduce disparities. They should encourage knowledge sharing and mentorship programs where digitally skilled younger employees can help train older employees, and vice versa, to balance expertise in digital and traditional work practices. The training programs that address specific generational needs, focusing on upskilling employees with lower digital proficiency to bridge the gap, should be implemented.

The overwhelming majority of respondents (77.59%) believe there are no noticeable gender-based differences in digital skills. This indicates that most organisations perceive digital skills to be relatively equal across genders.

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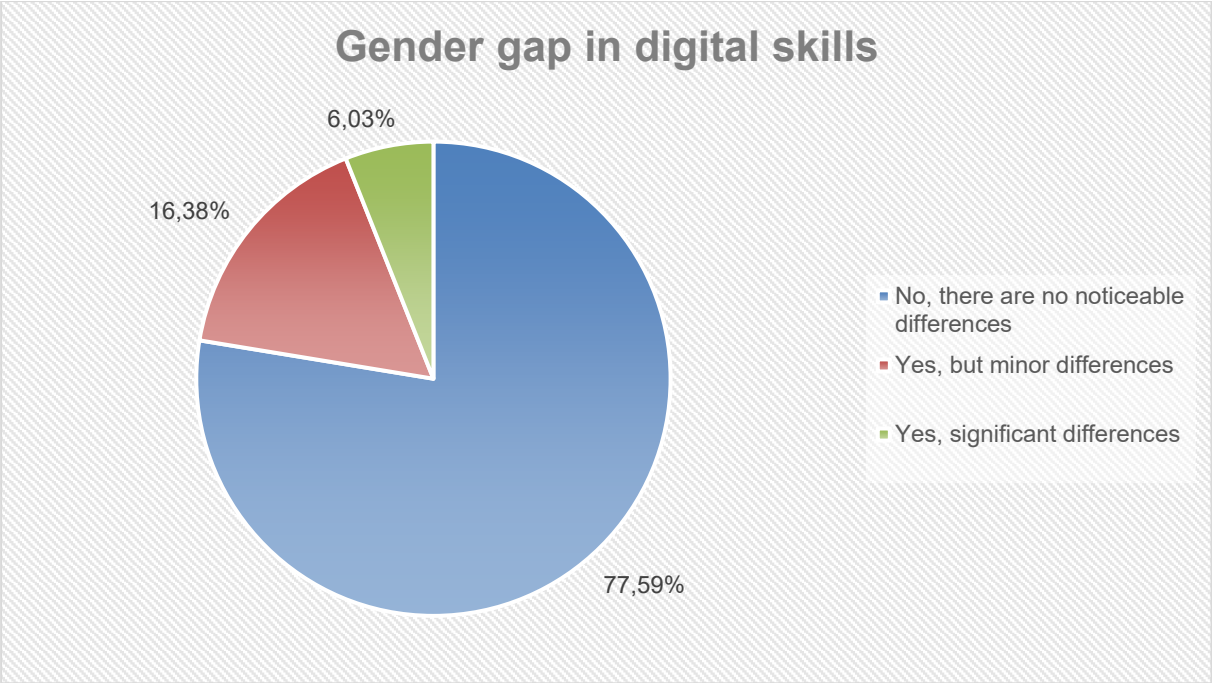

Figure 14: Gender-based differences in digital skills among employees in the organisations

The organisations where minor or significant differences are reported (according to the survey 16.38% + 6.03% of responses), should conduct deeper assessments to identify underlying causes (e.g., access, training opportunities, biases) and address them with targeted initiatives. The equal access to digital tools, training, and development opportunities should be continued promoting.

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