

What employers really see: hidden patterns in the skills of PhD holders

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SKILLS OF PHD HOLDERS THROUGH THE EYES OF COMPANIES IN FLANDERS WITH R&D-ACTIVITY

As an economic region, Flanders is committed to productivity growth. The strategic objectives outlined in the Flemish Policy Note on Economy, Science, Innovation, and Industry 2024-2029 (Diependaele, 2024) include additional investments in research, development, and innovation, as well as in the knowledge and skills of its inhabitants, enabling them to meet the needs of the (future) labor market. In that labor market PhD holders form a group with unique competencies. Approximately 9 out of 10 PhD holders eventually exchange the university workplace for a job in other sectors of the labor market (ECOOM-brief 39).

With regard to this non-academic labor market, in 2022 ECOOM HR in R&D, for the first time, examined employers' perspectives on PhD holders using the *Survey of Employers*, more specifically the perspectives of companies in Flanders with R&D activities. These companies account for the largest share of gross domestic expenditure on R&D (for example, in 2023, 71% of R&D expenditure in the Flemish Region was carried out by companies; Debackere et al., 2025). For more information on the design of the *Survey of Employers* 2022, the characteristics of the participating companies, their representativeness, and the topics covered, we refer to ECOOM-brief 48.

One of the topics covered in the *Survey of Employers* 2022 concerned the skills of PhD holders. In ECOOM-brief 59, we already reported how employers in companies with R&D activities in Flanders perceive 15 specific skills of PhD holders. This perception was assessed by presenting the following statement: "Our company believes that PhD holders (1) are experts, (2) can work autonomously, (3) are initiative takers, (4) are perseverant, (5) have a strongly developed learning ability, (6) have an innovative mindset, (7) are able to explain complex matters in a simple and understandable way, (8) prefer speed and pragmatism over accuracy and correctness, (9) have sufficient business skills/insight, (10) are sufficiently suited for leadership or management positions, (11) are sufficiently able to work together/in a team, (12) can

easily adapt to the pace of business, (13) can easily work on matters outside their specialty, (14) can easily apply their knowledge and translate it into practical implications and solutions and (15) work in a sufficiently results-oriented manner". The response options were (1) totally disagree; (2) disagree; (3) neither agree nor disagree; (4) agree; and (5) totally agree.

In the present ECOOM-brief, we take this a step further and address the following research question: *Is there a pattern in the skills of PhD holders as assessed by companies in Flanders with R&D-activity?*

To answer the above question, we proceed in two ways. The first way involves identifying patterns in the specific questions – referring to the concepts – used in the *Survey of Employers* 2022 (cf. concept-driven pattern detection). The second way involves identifying patterns in the specific responses provided by the respondents (i.e., the representative of the company completing the questionnaire) in the survey (cf. data-driven pattern detection).

CONCEPT-DRIVEN PATTERN DETECTION BASED ON THE EUROPEAN RESEARCHCOMP AND RM COMP

The *Survey of Employers* 2022 was collected during a period in which various policymakers sought to gain greater insight into the careers of researchers, and in particular of PhD holders, who had left the university. The research carried out by ECOOM HR in R&D, commissioned by the Flemish government, has consistently played a pioneering role in this regard, amongst others with the *PhD Career Survey*, which in 2017 provided, for the first time, insights into the careers of PhD holders both within and outside academia (see ECOOM-brief 25 and <https://www.phdcareersflanders.com/en>). Within the ECOOM-covenant 2019–2023, the multi-stakeholder perspective on researchers' careers was further expanded to include the perspective of employers through the *Survey of Employers* 2022. Among other topics, the survey assesses essential skills for PhD holders that were identified as relevant and important through a literature review (ECOOM-brief 32), the *PhD Career*

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Survey (ECOOM-brief 25; <https://www.phdcareersflanders.com/en>), and a series of stakeholder interviews (see Stassen et al., 2016). At almost the same time as the data collection of the *Survey of Employers 2022*, the European Commission published the *European Competence Framework for Researchers (ResearchComp)* (European Commission, 2022). The *ResearchComp* framework aims to provide a universally applicable inventory of relevant competencies that enable researchers to build successful careers both within and outside academia, while also promoting researchers' intersectoral and international mobility. Within this framework, competencies are defined as a combination of knowledge, skills, and attitudes. The framework also aims to provide inspiration and practical guidance for a wide range of purposes and stakeholders. For researchers, it can serve as a framework for self-assessment whether specific competencies are present or not. For employers, it can provide guidance in describing the competencies on which they may focus during selection and recruitment processes. For universities, *ResearchComp* can be used as a tool for developing training offers or personal development plans. For policymakers, it can help map the demand for and supply of competencies. The European Commission intends to deploy *ResearchComp* in various future initiatives (for example, the *Research and Innovation Careers Observatory*, <https://www.oecd.org/en/networks/research-and-innovation-careers-observatory.html>) and also promotes the general use of *ResearchComp* when discussing researchers' skills /competencies. Specifically for research managers, the European Commission has, since 2025, also provided the *European Competence Framework for Research Managers*, or *RM Comp* (European Commission, 2025).

In ECOOM-brief 59, we applied a post hoc, concept-driven mapping of the 15 skills surveyed in the *Survey of Employers 2022* onto the competence areas proposed by the European Commission through *ResearchComp* and *RM Comp*. This mapping is based on an interpretation of the descriptions of the competence areas provided in these European frameworks and is visualized in Figure 1.

The post hoc, concept-driven mapping was carried out in two steps.

Step 1: *ResearchComp* distinguishes seven competence areas: doing research, managing research, making an impact, self-management, cognitive abilities, working with others, and managing research tools. Together, these seven competence areas encompass 39 competencies. In addition, *ResearchComp* defines four proficiency levels: foundational, intermediate, advanced, and expert. Specific learning outcomes are associated with each proficiency level. The *ResearchComp* framework allowed, in Step 1, to assign a total of 11 of the 15 surveyed skills to a competence area. The skill 'being an expert' was linked to the competence area "doing research". The skills 'being able to work autonomously', 'taking initiative', and 'being perseverant' were linked to "self-management". The skill 'having a strongly developed learning ability' was linked to "cognitive abilities". The skills 'having an innovative mindset', 'being able to explain complex matter in a simple and understandable way', and 'can easily apply knowledge and translate it into practical implications and solutions' were linked to "making an impact". The skills 'being sufficiently suited for leadership

or management positions and 'being sufficiently able to work with others/in a team' were linked to "working with others". Finally, the skill 'working in a sufficiently results-oriented manner' can be linked to the competence area "managing research".

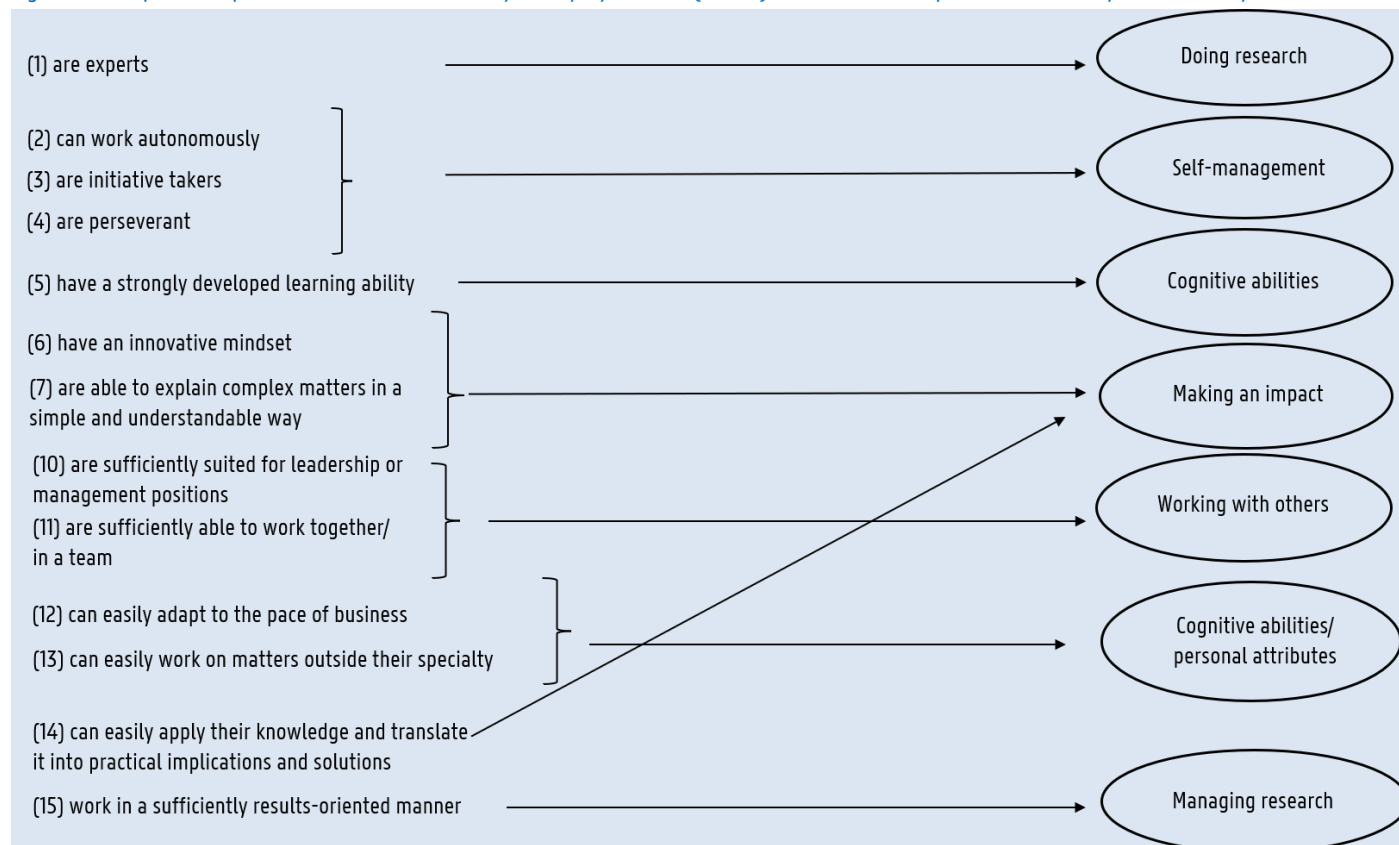
Step 2: In this step, we examined whether the four skills from the *Survey of Employers 2022* that could not be unambiguously linked to *ResearchComp* (European Commission, 2022) could instead be linked to *RM Comp* (European Commission, 2025). *RM Comp* likewise distinguishes seven competence areas: cognitive abilities/personal attributes, technical proficiency, research project oversight, stakeholder engagement, line management and talent development, communication, and subject-matter expertise/specialized knowledge. These seven competence areas encompass 50 competencies and use the same four proficiency levels as *ResearchComp*. In Step 2, we found that the two skills 'can easily adapt to the pace of business' and 'can easily work on matters outside their specialty' could be linked to the competency "adaptability and professional flexibility". According to *RM Comp*, this competency falls within the competence area "cognitive abilities/personal attributes". Two skills could not be linked to *RM Comp*: 'having sufficient business skills/insight' and 'preferring speed and pragmatism over accuracy and correctness'.

DATA-DRIVEN PATTERN DETECTION IN THE RESPONSES OF COMPANIES WITH R&D-ACTIVITY IN THE SURVEY OF EMPLOYERS 2022

Pattern detection in the responses to the 15 surveyed skills in the *Survey of Employers 2022* can be carried out using factor analysis. This statistical technique examines which skills tend to be rated in a similar way by companies with R&D activities. Based on similar response patterns, skills are grouped into a so-called factor. A factor thus reflects an underlying theme or construct. For example, a factor analysis of questions on psychosocial risks at work may reveal five factors (in Dutch the so-called "5 A's"): work organization, employment relationships, working conditions, terms of employment, and job content. Factor analysis therefore leads to the identification of underlying (latent) factors, each consisting of a set of related questions or concepts, or, in statistical terminology, related items. Researchers can subsequently obtain an approximate view of a factor by calculating a subscale score that represents the mean score across all items measuring that factor.

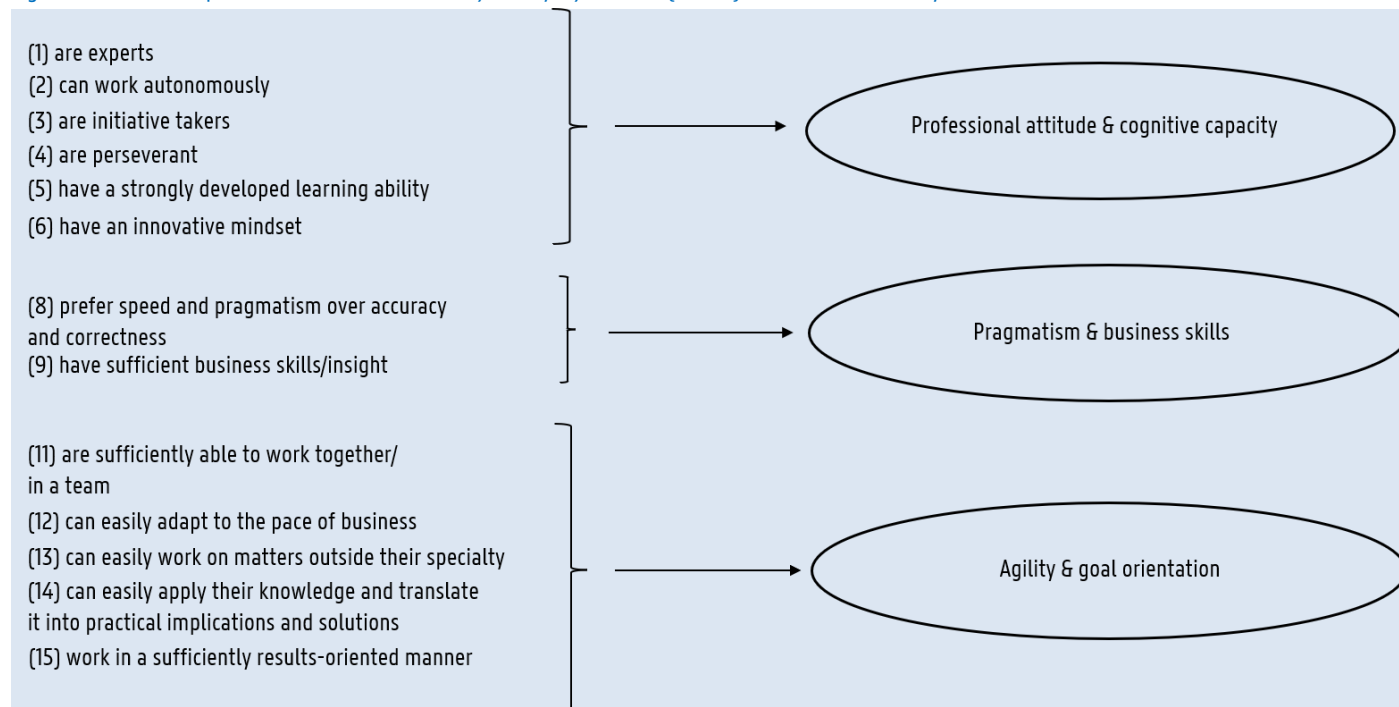
A factor analysis of the 15 skills surveyed in the *Survey of Employers 2022* indicates that three underlying factors can be identified based on 13 skills. Two skills do not appear to belong to any of the three identified factors. For details on the different steps in the factor analysis, we refer to the Appendix. Figure 2 provides a graphical representation of the three identified factors and their associated skills.

Figure 1. Concept-driven pattern detection in the *Survey of Employers 2022* (N=225) based on the European *ResearchComp* and *RM Comp*



Note. The skills 'prefer speed and pragmatism over accuracy and correctness' and 'have sufficient business skills/insight' are not included in the visual representation because they could not be linked to any of the competence areas described in either *ResearchComp* or *RM Comp*.

Figure 2. Data-driven pattern detection in the *Survey of Employers 2022* (N=225) based on factor analysis



Note. The skills 'being able to explain complex matter in a simple and understandable way' and 'being sufficiently suited for leadership or management positions' are not included in the visual representation because they were found not to belong to any of the three identified factors.

A first factor groups six skills that can be brought together under the label “professional attitude & cognitive capacity”. It concerns the following skills: ‘are experts’, ‘can work autonomously’, ‘are initiative takers’, ‘are perseverant’, ‘have a strongly developed learning ability’, and ‘have an innovative mindset’. A second factor groups two skills that can be brought together under the label “pragmatism & business skills”. It concerns the following skills: ‘prefer speed and pragmatism over accuracy and correctness’ and ‘have sufficient business skills/ insight’. A third factor groups five skills that can be brought together under the label “agility & goal orientation”. It concerns the following skills: ‘are sufficiently able to work together/in a team’, ‘can easily adapt to the pace of business’, ‘can easily work on matters outside their specialty’, ‘can easily apply their knowledge and translate it into practical implications and solutions’, and ‘work in a sufficiently results-oriented manner’.

Table 2 presents the subscale score for each of the three factors. We reiterate that the question on the various skills in the *Survey of Employers 2022* used five response categories: (1) strongly disagree; (2) disagree; (3) neither disagree nor agree; (4) agree; and (5) strongly agree. The mean subscale scores reported in Table 2 should be interpreted accordingly. For reference purposes, the mean scores for all 15 skills are also provided in the Appendix.

Table 2. Mean subscale scores (*Survey of Employers 2022*; N=225)

Subscale	Mean score
Professional attitude & cognitive capacity	3.67
Pragmatism & business skills	2.76
Agility & goal orientation	3.20

We observe that the mean score for the subscale “professional attitude & cognitive capacity” is 3.67, which is close to 4. This indicates that, on average, companies with R&D-activities tend to agree with the perception of PhD holders as employees who possess a professional attitude and cognitive capacities. The mean score for the subscale “pragmatism & business skills” is 2.67, while the mean score for the subscale “agility & goal orientation” is 3.20. Both scores are therefore close to 3. This means that, on average, companies with R&D activities tend to neither agree nor disagree with the perception that PhD holders possess “pragmatism & business skills”, as well as with the perception that PhD holders demonstrate “agility & goal orientation”.

DISCUSSION

In this ECOOM-brief, we build on data from the *Survey of Employers 2022* and on ECOOM-brief 59. While ECOOM-brief 59 described employers’ perceptions of 15 individual skills, the present analysis shows that, within the multitude of responses provided by respondents, there are three underlying patterns. Other sets of survey questions on skills may reveal different patterns. Identifying such patterns allows to reduce the complex set of 15 skills, that employers may take into account when evaluating the employability of PhD holders, to a limited number of interpretable patterns. This is essential for policymaking and further analyses (e.g., detecting differences depending on specific

company characteristics or depending on experience with the employment of PhD holders).

In this ECOOM-brief, we used two approaches to pattern detection: a concept-driven approach and a data-driven approach. The results of these two approaches are not identical, but rather complementary, and they present the Flemish government with choices in building an evidence base that can help optimize the interaction between supply (PhD holders) and demand (employers).

The first approach to pattern detection is concept-driven and shows how the skills surveyed in the *Survey of Employers 2022* align with the European frameworks *ResearchComp*, developed in 2022, and *RM Comp*, developed in 2025. These frameworks, provided by the European Commission, do not provide a questionnaire but rather offer a conceptual framework that distinguishes and describes various competence areas, competencies, skills, and proficiency levels. For *ResearchComp* a *self-assessment tool* is now also available.¹ Various initiatives are working on applying and testing these frameworks (e.g., ReSkillSpan², CROSS³, and BREATH⁴, all funded by Horizon Europe). Through these frameworks, the European Commission aims to promote the intersectoral and international mobility of researchers. If the Flemish government wishes to align its policies on researchers’ competence development more closely with the European frameworks and with OECD/European initiatives such as the *Research and Innovation Careers Observatory* (<https://ec.europa.eu/era-talent-platform/reico/>), then the set of skill-related questions in the next *Survey of Employers* will need to be revised. Greater alignment with the European frameworks would, however, imply reduced opportunities for reliably monitoring potential changes since 2022.

The second approach to pattern detection is data-driven and shows how companies with R&D-activities in Flanders perceive the surveyed skills among PhD holders in the *Survey of Employers 2022*. The data-driven pattern detection points to a clear distinction between three patterns. A first pattern reflects a fairly consistent and positive perception among companies regarding the presence of “professional attitude & cognitive capacity” among PhD holders. This first pattern is not particularly surprising and is in line with existing insights from the literature, as reported in ECOOM-brief 32, as well as with previous ECOOM-research in which we asked a variety of stakeholders in Flanders about the added value of a PhD through a series of interviews (see Stassen et al., 2016). Regarding the second and third pattern, companies with R&D activities did not appear to hold a pronounced opinion. The second pattern encompasses skills related to speed, pragmatism, and business-oriented insights. The third pattern concerns collaboration with others, adaptability, the ability to apply knowledge, and results orientation. Patterns 2 and 3 are noteworthy: a large proportion of employers selected “neither agree nor disagree” when asked whether PhD holders possess these skills (see also ECOOM-brief 59 for response frequencies). The strong presence of the middle response category, “neither agree nor disagree”, in employers’ responses is not a minor detail but a key finding that calls for possible explanations. We propose five potential explanations, which are not mutually exclusive. A first possible explanation is that survey respondents may have insufficient insight

into the skills of their current and/or former PhD holders, for example due to limited experience, large organizational size, or employee turnover. A second possible explanation is the heterogeneity of PhD holder profiles: within a single company, both stronger and weaker profiles may be present, leading respondents to refrain from expressing a clear judgment. A third possible explanation is the limited relevance of the PhD as a reference point: in some companies, a PhD is simply not an explicit selection or evaluation criterion, resulting in the absence of pronounced perceptions. A fourth possible explanation could be an incomplete or outdated understanding of the PhD: employers may not be sufficiently familiar with the PhD track or may rely on outdated perceptions, despite investments by the Flemish government and universities in the development of so-called *transferable skills* during the PhD program. *Transferable skills* are not specialized skills common for the PhD or the research discipline but rather skills that can be applied in virtually any role, sector, or stage of life. Finally, methodological factors may also contribute to the strong presence of “neither agree nor disagree” in employers’ responses. For example, the wording of certain survey items (e.g., “having sufficient business skills”) may invite differences in interpretation. Respondents may therefore not evaluate the skill from the same frame of reference (what constitutes “sufficient”? in which context?), leading them to select a neutral response. All of these explanations point in the same direction: a mean score close to 3 does not necessarily indicate a perceived absence of skills, but may instead reflect the absence of a clear perception. This unclarity is, in itself, an important finding. For policy and practice, caution is needed. The results do not allow conclusions to be drawn about the quality of PhD training programs, nor do they support the establishment of priority lists of skills on which universities should ideally place greater emphasis during the PhD track. They do, however, reveal where clarity is lacking in the interaction between supply (PhD holders) and demand (employers). From these findings, three lines of inquiry for future research and policy emerge. First, there is a need for a better understanding of the concrete needs of companies, ideally differentiated by job function, sector, and context. Second, it is important to understand the extent to which employers recognize and utilize the skills possessed by PhD holders, and where (stereotypical) perceptions and reality may diverge. Third, the question arises as to what employers need in order to overcome potential barriers that hinder the recruitment or optimal deployment of PhD holders within their organizations. Future data collections focusing on these three lines of inquiry would benefit from precise question wording and context-specific survey items, complemented by qualitative research (for example, interviews with employers). In summary, the principal added value of the present analysis does not lie in ranking the skills that PhD holders do or do not (yet) possess. Rather, it lies in using data to reveal where consensus exists among employers with R&D-activities and where uncertainty predominates. It is precisely these areas of uncertainty that are crucial. They point to blind spots in knowledge and perception and provide a starting point for further analysis and policy dialogue. We further explore this in a next ECOOM-brief. More specifically, we ask whether perceptions of the

skills of PhD holders are more unequivocal among employers in certain types of companies, or in companies engaged in specific types of business activities (such as particular types of R&D-activity or innovation).

LINKS

¹ <https://projects.research-and-innovation.ec.europa.eu/en/jobs-research/researchcomp-european-competence-framework-researchers/self-assessment-tool>

² <https://impactfulresearchercareers.eu/>

³ <https://cordis.europa.eu/project/id/101216919>

⁴ <https://breathproject.eu/>

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APPENDIX

We used *Principal Axis Factoring* with oblique rotation. This resulted in three factors that together explain 66.3% of the variance across 13 perceived items. Two of the 15 surveyed items did not show a clear association with any of the three factors and were therefore not assigned to a factor. These were the items 'being able to explain complex matters in a simple and understandable way' and 'being sufficiently suited for leadership and management positions'. When these two items are excluded from the analysis, a clear three-factor solution emerges. Table A presents all factor loadings above .30 for the 13 items. Table B reports the mean subscale scores for the three factors, together with the mean item scores for all items associated with each factor, as well as the mean item scores for the two items that were not assigned to any of the factors.

Table A. Factor loadings >.30 (*Survey of Employers 2022, N=225*)

	Factor 1	Factor 2	Factor 3
Are experts	.626		
Can work autonomously	.779		
Are initiative takers	.834		
Are perseverant	.815		
Have a strongly developed learning ability	.742		
Have an innovative mindset	.639		
Prefer speed and pragmatism over accuracy and correctness		.705	
Have sufficient business skills/insight		.646	
Are sufficiently able to work together/in a team			-.630
Can easily adapt to the pace of business			-.469
Can easily work on matters outside their specialty			-.742
Can easily apply their knowledge and translate it into practical implications and solutions			-.645
Work in a sufficiently results-oriented manner			-.505

Table B. Mean subscale score for the 3 factors, mean item scores for the associated items, and mean item scores for the two separate items (*Survey of Employers 2022; N=225*)

Subscale	Mean score
<i>Professional attitude & cognitive capacity</i>	<i>3.67</i>
Are experts	3.74
Can work autonomously	3.76
Are initiative takers	3.42
Are perseverant	3.59
Have a strongly developed learning ability	3.87
Have an innovative mindset	3.63
<i>Pragmatism & business skills</i>	<i>2.76</i>
Prefer speed and pragmatism over accuracy and correctness	2.73
Have sufficient business skills/insight	2.78
<i>Agility & goal orientation</i>	<i>3.20</i>
Are sufficiently able to work together/in a team	3.24
Can easily adapt to the pace of business	3.08
Can easily work on matters outside their specialty	3.06
Can easily apply their knowledge and translate it into practical implications and solutions	3.28
Work in a sufficiently results-oriented manner	3.33
Separate items	Mean score
Being able to explain complex matters in a simple and understandable way	3.28
Being sufficiently suited for leadership and management positions	2.98