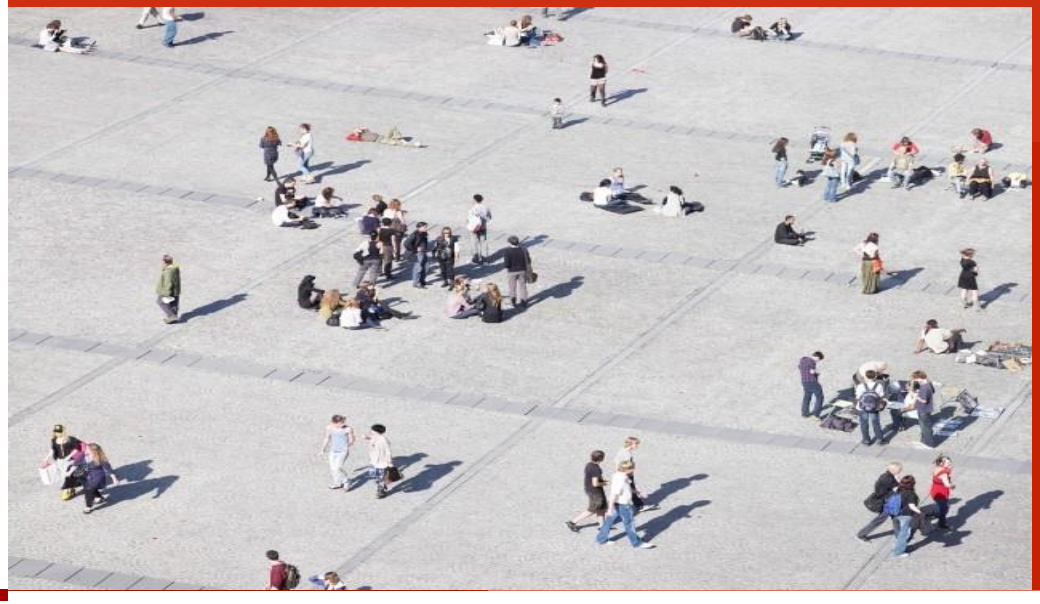
www.pwc.com

Skill requirements for KETs

Vision and Sectoral Pilot on Skills for Key Enabling Technologies

European Conference on Skills for Key Enabling Technologies and Digital Economy

Brussels, 1 June 2015



EUROPEAN COMMISSION,
Directorate General for Internal Market, Industry, Entrepreneurship and SMEs

Unit GROW-F3 KETs, Digital Manufacturing and Interoperability

Speaker:
Dr. Kristina Dervojeda
Project Manager and Senior Expert, PwC Innovation Research Centre
Tel.: +31 88 79-3228
Email:
kristina.dervojeda@nl.pwc.com

Key question

What kind of skills do employers need from KETs workers?

General answer

It depends…

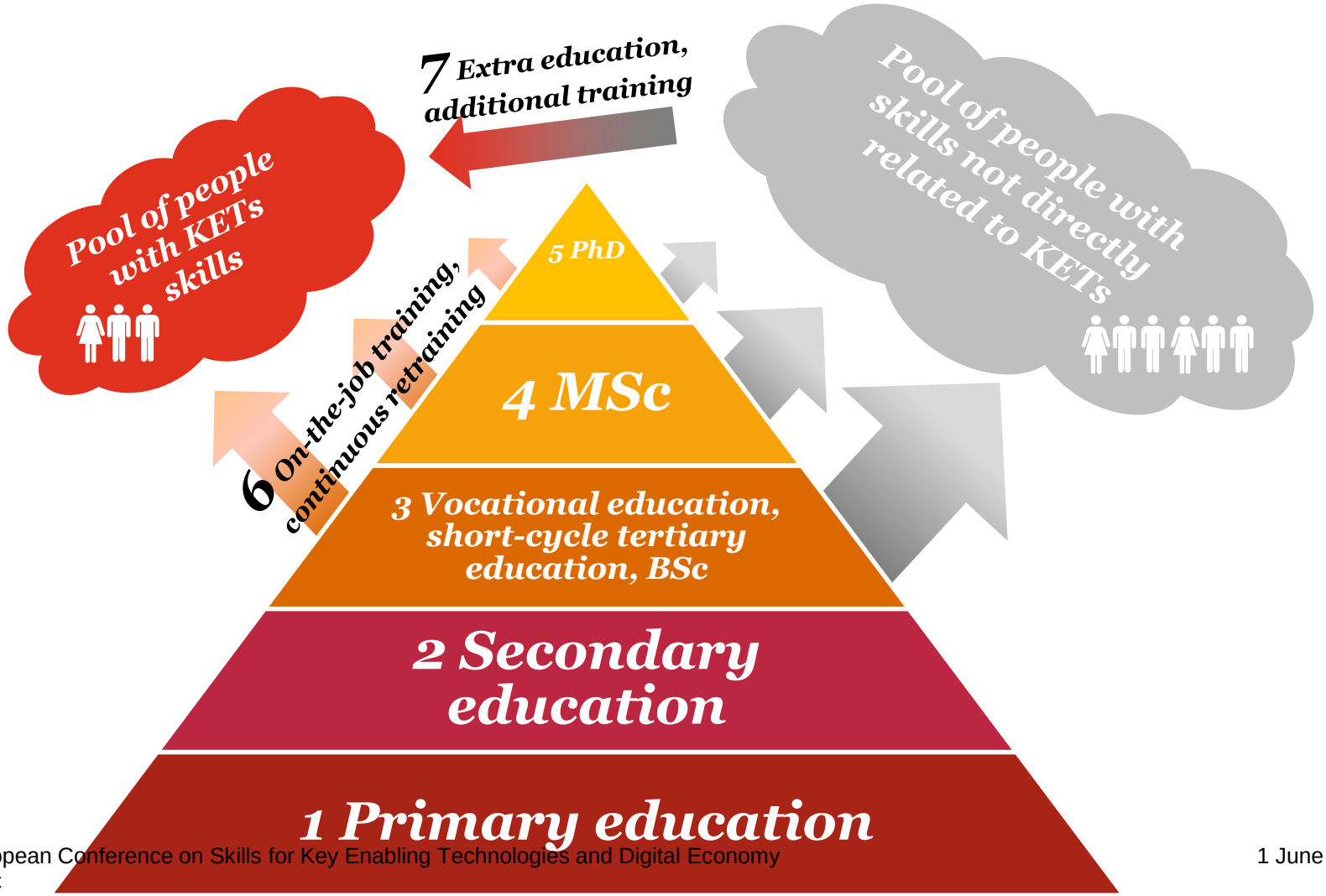
General answer

It depends on:

- KET/industry/application area
- company size
- job profile/specific occupation
- hierarchical level
- …

Skill requirements for KETs

High diversity of relevant educational levels



Skill requirements for KETs

High diversity of educational backgrounds (heavily relying on STEM, but broader than STEM)

Skill requirements for KETs

Skill framework

6 Categories of Skills for Key Enabling Technologies

1 Technical	2 Quality, risk & safety	3 Management & entrepreneurship	4 Communication	5 Innovation	6 Emotional intelligence
competences related to practical subjects based on scientific principles (e.g. characterisation, systems integration, mathematical modelling and simulation, top-down fabrication etc.)	competences related to quality, risk & safety aspects (e.g. quality management, computer-aided quality assurance, emergency management and response, industrial hygiene, risk assessment etc.)	competences related to management, administration, IP and finance (e.g. strategic analysis, marketing, project management, IP management, deal negotiation skills etc.)	competences related to interpersonal communication (e.g. verbal communication, written communication, presentation skills, public communication, virtual collaboration etc.)	competences related to design and creation of new things (e.g. integration skills, complex problem solving, creativity, systems thinking)	ability to operate with own and other people's emotions, and to use emotional information to guide thinking and behaviour (e.g. leadership, cooperation, multi-cultural orientation, stress-tolerance, self-control etc.).

Skill requirements for KETs

100+ identified competences with focus on multi-KETs

Nr	Competence	Pillars	
		Technological research	Product development
	1 TECHNICAL		
	1.1 Technical background	✓	✓
1.	Chemistry	✓	✓
2.	Physics	✓	✓
3.	Engineering (incl. Systems Engineering)	✓	✓
4.	Electronics	✓	✓
5.	Biology	✓	✓
6.	Optics	✓	✓
7.	Photonics	✓	✓
8.	Computer science	✓	✓
9.	Nanoscience	✓	✓
10.	Materials Science	✓	✓
11.	Mathematics	✓	✓
12.	Statistics	✓	✓
13.	Metrology	✓	✓
	1.2 Design	✓	✓
14.	Design Methodology	✓	✓
15.	Operations Analysis	✓	
16.	Systems Analysis	✓	
17.	Computer-Aided Design (CAD)	✓	
18.	Multidisciplinary design optimisation	✓	✓
19.	Process Layout & Optimisation	✓	✓
20.	Life-cycle analysis	✓	✓
21.	Scalability analysis	✓	✓
	1.3 ICT skills	✓	✓
22.	Computer skills	✓	✓
23.	Programming	✓	✓
24.	Computational thinking	✓	✓
	1.4 Modelling and simulation		✓
25.	Mathematical modelling and simulation	✓	✓
26.	Computer-Aided Engineering (CAE)		✓
27.	Non-destructive testing		✓
28.	Real-time modelling and simulations		✓
	1.5 Equipment handling skills		✓
29.	Equipment Selection		✓
30.	Installation		✓
31.	Equipment running skills		✓
32.	Operation Monitoring		✓
33.	Troubleshooting skills		✓
34.	Maintenance, Repair and Overhaul (MRO)		✓
	1.6 Manufacturing		✓
35.	Process improvement tools		
36.	Computer-Aided Manufacturing (CAM)		
37.	Systems Evaluation		
38.	Standard Operating Procedures (SOP)		
39.	Product labelling and packaging		
40.	Top-down fabrication techniques		✓
41.	Bottom-up fabrication techniques/Synthesis	✓	✓
42.	Micro-assembly		
43.	Macro-assembly		
	1.7 Diverse other technical competences	✓	✓
44.	Systems integration	✓	✓
45.	Characterisation and analysis	✓	✓
46.	General Lab Skills	✓	✓
47.	Specific Lab Skills	✓	✓
	2 QUALITY, RISK & SAFETY		
	2.1 Quality	✓	✓

Nr	Competence	Pillars		
		Technological research	Product development	Competitive manufacturing
48.	Quality management	✓	✓	✓
49.	Computer-Aided Quality Assurance (CAQ)	✓	✓	✓
50.	Quality Control Analysis	✓	✓	✓
	2.2 Risk & safety	✓	✓	✓
51.	Risk Assessment	✓	✓	✓
52.	Working conditions/ Health and safety	✓	✓	✓
53.	Emergency Management and Response	✓	✓	✓
54.	Industrial Hygiene	✓	✓	✓
55.	Equipment Safety	✓	✓	✓
56.	Ethics	✓	✓	✓
	3 MANAGEMENT & ENTREPRENEURSH			
	3.1 Business development	✓	✓	✓
57.	Strategic analysis	✓	✓	✓
58.	Technology strategy	✓	✓	✓
59.	New Product and Process Development (NPPD)	✓	✓	✓
60.	Marketing	✓	✓	✓
61.	Customer Focus	✓	✓	✓
	3.2 Operational management	✓	✓	✓
62.	Project Management	✓	✓	✓
63.	Time Management	✓	✓	✓
64.	Teamwork skills	✓	✓	✓
65.	Coaching & Developing	✓	✓	✓
66.	Delegation skills	✓	✓	✓
67.	Monitoring	✓	✓	✓
68.	Risk Management	✓	✓	✓
69.	Management of Personnel Resources	✓	✓	✓
70.	Management of Financial Resources	✓	✓	✓
71.	Supply chain management	✓	✓	✓
72.	Cost modelling skills	✓	✓	✓
73.	Generation of shop floor work instructions	✓	✓	✓
74.	Procurement skills	✓	✓	✓
	3.3 Entrepreneurship	✓	✓	✓
75.	Deal negotiation skills	✓	✓	✓
76.	Acquisition of funding	✓	✓	✓
78.	Intellectual Property (IP) management	✓	✓	✓
79.	International regulatory affairs	✓	✓	✓
	4 COMMUNICATION	✓	✓	✓
80.	Interpersonal skills	✓	✓	✓
81.	Verbal communication	✓	✓	✓
82.	Written communication	✓	✓	✓
83.	Presentation skills	✓	✓	✓
84.	Public communication	✓	✓	✓
85.	Virtual collaboration	✓	✓	✓
	5 INNOVATION	✓	✓	✓
86.	Integration skills	✓	✓	✓
87.	Design mind-set	✓	✓	✓
88.	Continuous experimentation	✓	✓	✓
89.	Complex Problem Solving	✓	✓	✓
90.	Creativity	✓	✓	✓
91.	Systems thinking	✓	✓	✓
	6 EMOTIONAL INTELLIGENCE			
	6.1 Self-management	✓	✓	✓
92.	Persistence	✓	✓	✓
93.	Passion, enthusiasm and curiosity	✓	✓	✓
94.	Sense of responsibility	✓	✓	✓
95.	Stress tolerance	✓	✓	✓
96.	Attention to detail	✓	✓	✓
97.	Adaptability	✓	✓	✓
98.	Ability to thrive on failures	✓	✓	✓

Nr	Competence	Pillars		
		Technological research	Product development	Competitive manufacturing
99.	Balancing life and work demands	✓	✓	✓
100.	Self-discipline	✓	✓	✓
101.	Self-control	✓	✓	✓
102.	Proactivity	✓	✓	✓
103.	Continuous improvement orientation	✓	✓	✓
104.	Active Learning	✓	✓	✓
105.	Alertness	✓	✓	✓
106.	Judgment and decision making	✓	✓	✓
	6.2 Social skills	✓	✓	✓
107.	Friendliness/Being respectful of others	✓	✓	✓
108.	Leadership	✓	✓	✓
109.	Integrity	✓	✓	✓
110.	Cooperation	✓	✓	✓
111.	Multi-cultural/global orientation	✓	✓	✓

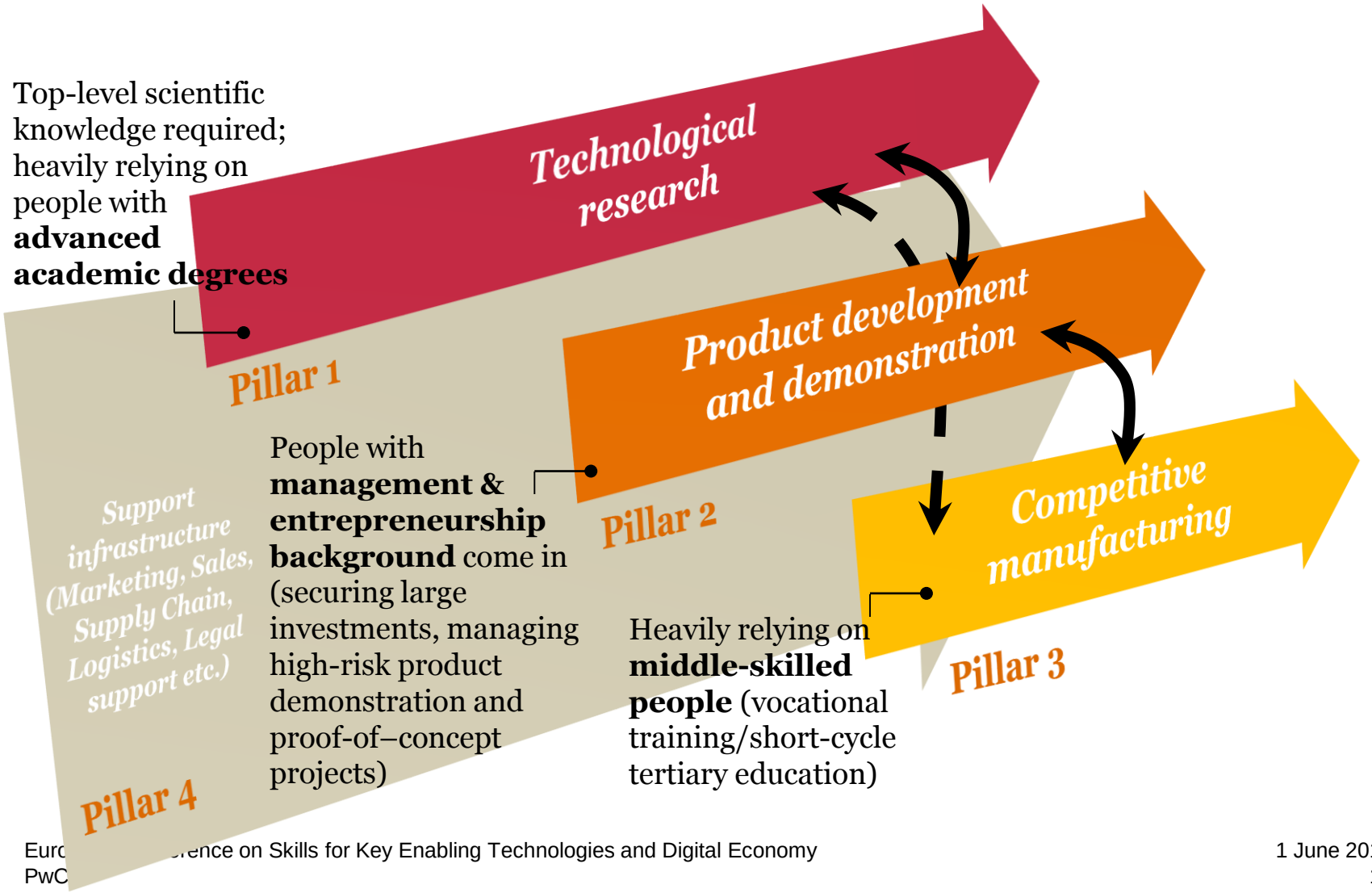
Skill requirements for KETs

100+ identified competences with focus on multi-KETs

- A high diversity in skill requirements for KETs ***can never be covered by a single person or even a company***.
- ***'Smart' combinations of people with diverse profiles are needed***, with many of them coming from domains not directly related to KETs (application areas).
- Even in case of 'soft' roles like marketing and sales, ***KETs companies in general prefer to hire technical people with basic business skills*** rather than business people with basic technical skills

Skill requirements for KETs

Difference in terms of skill needs between KETs pillars



Skill requirements for KETs
Collective KETs competences

- Besides individual competences, KETs also heavily rely on ***collective competences***.

Skill requirements for KETs
General observations

- ***KETs heavily rely on people from general STEM domains***. At the same time, business support roles are typically filled by non-technical people. However, in terms of total employment, they form a minority in KETs.

- In order to maintain a competitive position in KETs, we need to teach our students ***learning-to-learn skills, alertness, adaptability, continuous experimentation*** and ***ability to thrive on failures***, and particularly ***collective competences***, including integration skills.

Skill requirements for KETs
General observations

In what respect are KETs skills unique?

- Rather than some particular competences, ***it is a combination of the individual and collective competences, linked to an endless number of potential application areas***, what makes KETs skill requirements unique.

- KETs commercialisation trajectories are linked to knowledge and skills from literally every field of life.

Thanks a lot for your attention!