



METIS

Deliverable 2.2 – Annex 1

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Microelectronics Training, Industry and Skills (METIS) project number 612339-EPP-1-2019-1-DE-EPPKA2-SSA-B under the action Sector Skills Alliances in vocational educational education and training Grant Agreement number 612339-EPP-1-2019-1-DE-EPPKA2-SSA-B

ANNEX 1

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Annex 1 - Approach to identify skills and occupational profiles

1) Methodology

The METIS project has adopted a multi-stakeholder's approach to skills identification, and the primary research to identify skills and occupational profiles have consisted in 50 interviews, 10 focus groups and an online survey.

DECISION Etudes & Conseil has been the leading partner of the consortium for EU sectoral skills strategy, skills anticipation and monitoring (WP2). DECISION's scope of actions included the coordination of the METIS actions, through its experience and expertise in electronics market research, analysis and forecasting.

The main roles of each partner are described below:

Type of partner	Partner	Main role
Market research & intelligence firm	DECISION Etudes & Conseil	Leading partner / coordination
Industry partners	Infineon Technologies Austria	Provide the perspective of private sector and industry for the trends affecting skills, competences and employment
	Robert Bosch	
	X-Fab France	
	Graphenea Semiconductor	
	Summa Semiconductor	
Education & training partners	Arcelik	Provide the perspective of the supply side, representing the needs of the learners and workers
	Technische Universitat Graz	
	Interuniversitair Micro-Electronica Centrum IMEC	
	Dresden Chip Academy	
	University of South-Eastern Norway	
	Technical University of Sofia	
	Budapest University of Technology and Economics	
Innovazione Apprendimento Lavoro-Friuli Venezia Giulia		
Regulatory body	CIMEA	Provide the perspective of the certification and accreditation bodies
Associations	Silicon Saxony	Connect METIS with the industry Provide perspective of their sector as a whole.
	SEMI Europe	
NGOs	WiTEC	Provide incentives on both supply & demand sides. Providing the perspective of the underrepresented groups

- *Direct interviews*

50 direct interviews took place from April to December 2020, with experts from the industry, universities, civil society and other relevant EU/international organizations, using a single questionnaire

adapted to take into account the specificities of the respondents: companies or other types organisations.

In terms of methodology, interviews are in between the online questionnaire and the focus groups, as there are composed of quantitative questions to complement the online questionnaire but are also composed of large questions on the global evolution of skills in Europe and the World and by specific topics (in order to provide policy recommendations, identify best practices and HR initiatives, complement the different focus groups, etc.).

Table: Organisations interviewed

Value chain level	Type of organisation	Name	Number of interviews
Automaker	Large company	Ford Otosan	1
Original Equipment Manufacturer (OEM)	Large company	Magnetti Marelli	1
		Fronius	1
		Arcelik	1
	Mid-sized company	Karel	1
Semiconductor	Large company	Infineon	4
		ST Microelectronics	1
		Bosch Semiconductor	4
		GlobalFoundries	1
	Mid-sized company	X-Fab	5
	SME	OMMIC	1
		Merit Sensor	1
		BüyüTech	1
Summa Semiconductor		1	
Semiconductor equipment	Large company	ASML	2
		LAM Research	1
		Thermo Fisher	1
		ASMI	1
	Mid-sized company	VAT Group	1
		DAS-EE	1
Semiconductor materials	Large company	Toppan Photomasks	1
	SME	Graphenea	1
Passive components	Large company	Murata Electronics	1
PCB	Large company	AT&S	1
R&D	Research & Technology Organisations	CITRIS	1
		Fraunhofer IPMS	1
		Memsfab	1
		Joanneum Research	1
Education	University	National Tsing Hua University	1
		TU Graz	1
		TU Sofia	1
		BME	1
		University of Udine	1
		University of Campania	1
		University of Cyprus	1
	VET	Dresden Chip Academy SBH Sudost (DCA)	1

Industry Association	Silicon Saxony	1
International organisation	World Economic Forum	1
Regulatory body	NESH - National Electronics Society of Hungary (MELT)	1

Focus groups

Ten focus groups have been achieved from April to October 2020, consisting in consultation, roundtables and panels of global leading experts in the sector, representing companies, education institutions, social partners and analysts.

These focus groups, or workshops, have involved at least 5 participants from 5 different organizations, either physical or remotely, with a gender balance and a balance between industrials, education & training organisations and NGOs. In total, 103 stakeholders from 57 organisations have been engaged through the focus groups.

The aim of the focus groups is to collect qualitative analyses of microelectronics skills needs in Europe from key stakeholders on specific issues. There are three types of topics:

- 4 Focus groups dedicated to setting up a roadmap of the existing and future skills needs at specific value chain levels (e.g., semiconductor design).
- 3 Focus groups dedicated to setting up a roadmap of the future skills needs in microelectronics in line with specific technological developments (innovations in automotive, Industry 4.0 and edge AI).
- 3 Focus groups dedicated to other specific topics:
 - Diversity in electronics: The representativity of minorities within the electronics industry.
 - EU policy perspective: The vision of EU policy makers.
 - Validation from education: Identification of the best practice in Europe in terms of defining occupational profiles through different industry sectors.

Table: Topics and description of Focus Groups

Topic	N°	Focus Groups Themes	Description
Skills needs at specific value chain level	1	Materials for semiconductors	Microelectronics skills issues from the point of view of materials companies
	2	Semiconductor manufacturing equipment	Microelectronics skills issues from the point of view of semiconductor manufacturing equipment companies
	3	Semiconductor manufacturing	Microelectronics skills issues from the point of view of semiconductor manufacturing companies
	4	Semiconductor design	Microelectronics skills issues from the point of view of semiconductor design companies
Microelectronics skills needs in line with emerging	1	Edge AI	How is Edge AI leading to new skills requirements in Microelectronics?
	2	Microelectronics & automotive	Impact of automotive innovations on microelectronics skills needs (ADAS, electrification of powertrains, etc.)



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technologies and markets	3	Industry 4.0	New skills needs in electronics manufacturing in view of industry 4.0
Other	1	Validation of education	Good practices developed within Erasmus+ projects / Assessing differences among national education & training systems
	2	EU Policy perspective	EU policy and microelectronics
	3	Diversity in Electronics	The place of women and other under-represented groups in Electronics

Table: Participants to Focus Groups

Topic	N°	Focus Groups Themes	Participants
Skills needs at specific value chain level	1	Materials for semiconductors	Semilab / PORT / Okmetic / JSR Micro / Axcelis / SEMI / BMU / Graphenea
	2	Semiconductor manufacturing equipment	Tokyo Electron / Edwards / EMD Performance / SEMI / Dresden Chip Academy / University of York and Bristol
	3	Semiconductor manufacturing	Bosch / X-Fab / Infineon / STMicroelectronics / GlobalFoundries / Summa Semiconductor
	4	Semiconductor design	Infineon / NXP / Bosch / ST Microelectronics / IMEC / Fraunhofer / TU Graz / USN / IC Sense / Melexis / EMD Performance materials / Riot Micro
Microelectronics skills needs in line with emerging technologies and markets	1	Edge AI	IMEC / Fraunhofer / SEMI / Zhejiang University / Center for Data Innovation / Sainsbury
	2	Microelectronics & automotive	Infineon / Automotive Lightning / MetaSystem/ IAL FVG / University of Udine Polytechnic Department of Engineering and Architecture
	3	Industry 4.0	BME / Institute of Electron Technology / Vienna University of Technology / Czech Technical University Prague / Technical University of Cluj-Napoca, Romania / Politecnico di Torino / PwC Innovation Center, Netherlands
Other	1	Validation of education	CIMEA / TU Sofia / TU Graz / IMEC / SBH Sudost / IAL-FVG / ENAEE / SEMI
	2	EU Policy perspective	DG GROW / DG EMPL / DG CONNECT / DG RTD / ENAEE / SEMI / DECISION Etudes & Conseil / IAL-FVG / Bosch / ST Microelectronics / Summa Semiconductor
	3	Diversity in Electronics	WiTEC / Lund University / CNRS / Infineon / Edwards / ENHI (European Network for Holistic Integration) / Guidewire software

Online survey

An online survey has been carried out from July to November 2020 and gathered 98 answers from 63 organisations.

This online survey has enabled the creation of a quantitative data base on skills needs in Europe (answers are composed of figures and closed questions). The results are aggregated and fully anonymous. Every partner has disseminated the online questionnaire a maximum number of answers to the survey.

Secondary research

Secondary Research has consisted in the review of existing studies, analyses and statistical publication linked to microelectronics skills needs in Europe through desk research.

Within secondary research, a **job market analysis** has been carried on in order to determine the job profiles the most sought-after in the European microelectronics industry in 2020 and serve as a basis for the interviews, focus groups and online survey.

- First, a screening of the most advertised jobs has been made on the website “Indeed” with the keyword’s “IC” and/or “semiconductor” in the US. The result gave 11 121 jobs advertised. Among these job profiles, an analysis has been made by keyword frequency to identify the most common roles, leading to the identification of 11 job profiles and their associated skills / knowledge required.
- Second, this job market analysis has been complemented by METIS education & training partners in order to set up a complete list of associated skills and knowledge to each of these 11 job profiles and adapted to make sure they are coherent with the needs of the European job market.
- Finally, these 11 job profiles have served as a basis for the interviews and focus groups guidelines and questionnaires. The 50 stakeholders interviewed as well as the participants of seven focus groups provided their feedbacks on these job profiles, skills and knowledge, and proposed additional ones when they felt necessary.

DECISION has also used its **expertise on the European electronics industry** to provide insights in the report. The results of three recent studies made by DECISION for the European Commission have especially nurtured the report:

- Emerging technologies in Electronic Components and Systems (ECS) – Opportunities ahead, DG CONNECT, 2020.
- Study on the electronics ecosystem: Overview, developments and Europe’s position in the world, DG CONNECT, 2019.
- Study on the competitiveness of the EU engineering industries and the impact of digitalisation, EASME, 2020.

Examples of documents analyzed and integrated to the report:

- Report “[Developing Skills Foresights, scenarios and forecasts](#)”, from ETF, CEDEFOP and ILO, published in 2016.
- Statistics from the European Commission: Digital Economy and Society Index (DESI), Digital Transformation Monitor, Advanced Technologies for Industry (ATI), etc.



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- Report “Insights of the Automotive Sector”, from DRIVES (Development and Research on Innovative Vocational Education Skills), co-funded by the Erasmus+ Programme of the European Union, published in 2016.
- Report “Closing gender divides in digital skills through education”, from Equals Global Partnership with the support of the United Nations Educational, Scientific and Cultural Organization and the German Federal Ministry for Economic Cooperation and Development, published in 2019.
- ...

2) **Achievements: the entire European microelectronics value chain reached** Through the online survey, the focus groups and the interviews, **METIS has engaged 251 stakeholders from 159 organisations.**

In total, METIS has engaged 30 of the largest European and global microelectronics companies as well as many mid-sized businesses and SMEs. In total, **companies engaged in METIS produce goods and services for €130B across the microelectronics value chain in 2019, corresponding to 20% of the global production across the microelectronics value chain. Furthermore, these companies provide more than 125 000 microelectronics jobs across Europe, corresponding to 30% of the European microelectronics workforce.**

Education & training organisations engaged in the identification of skills and occupational profiles represent nearly 5 000 students in microelectronics¹ across Europe.

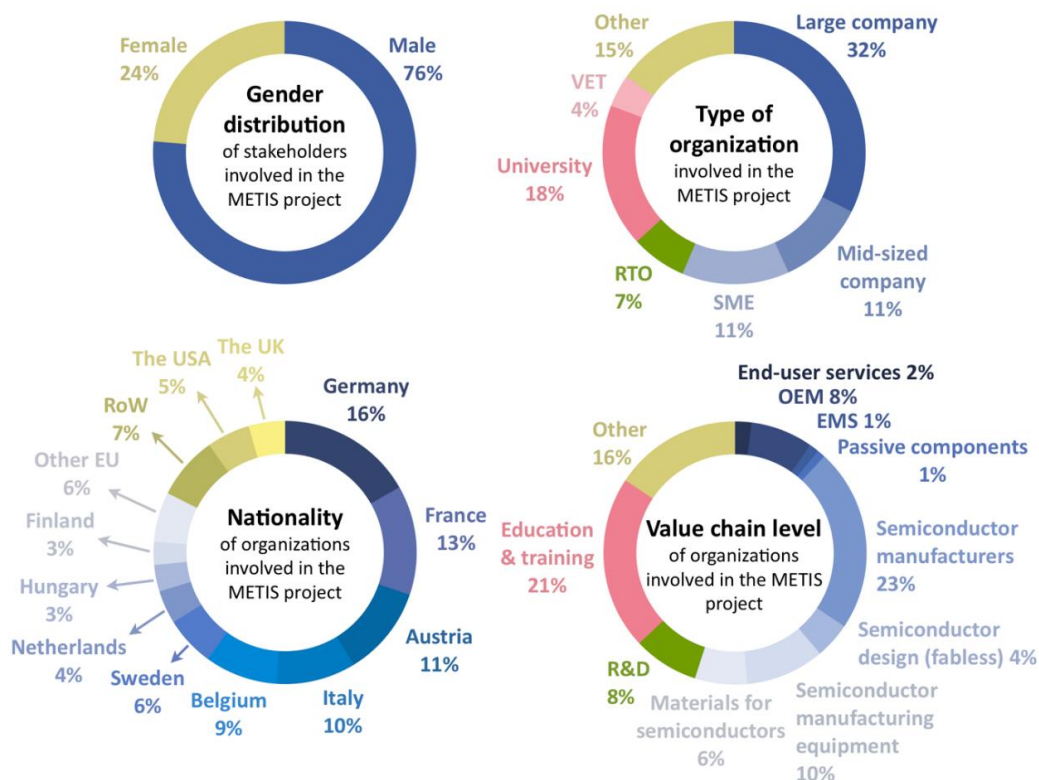
The entire electronics value chain has been involved: Service companies using electronic systems (2%), Original Equipment Manufacturers (OEM – Manufacturers of electronic systems) (8%), Electronic Manufacturing Service providers (EMS) (1%), passive components manufacturers (1%), semiconductor manufacturers (23%), semiconductor designers / fabless (4%), manufacturers of semiconductor manufacturing equipment (10%), suppliers of materials for semiconductors (6%), and companies specialized in Research and Development (R&D) (8%). Education & training organisations account for 21% of the total, and other organisations for 15% (European Commission, industry associations, NGOs, Regulatory bodies, consulting firms and international organisations). In total, 43% of the organisations engaged are companies from the microelectronics industry.

One of the goals of METIS is to identify the **skills needs within the European industry** (demand for jobs and skills). This goal has been reached and **companies represent 55% of the organisations engaged**, in majority large companies (32%). Research and Technology Organisations (such as the IMEC, Fraunhofer institutes or the CEA Leti), account for 7%, Universities for 18%, Vocational Education and Training providers (VET) for 4% and other organisations for 15% (European Commission, industry associations, NGOs, Regulatory bodies, consulting firms and international organisations).

A specific effort has been made to have a **gender balance** among the stakeholders involved. In 2018, according to Eurostat, women accounted for 20% of the workforce of European Scientists and engineers involved in the industrial activities (that is excluding services). We have succeeded to engage 24% of females, that is slightly above the average of the sector.

¹ Students in courses where training related to microelectronics has a significant place.

Finally, **90% of the organisations engaged in METIS are European** (82% part of the European Union). The distribution of the nationality of the stakeholders engaged in METIS is coherent with the distribution of the microelectronics industry in the World and in Europe. The non-European countries with organisations participating in METIS are the USA (5%), Turkey (2%), Japan (2%), China (1%), and Malaysia.



Map – Stakeholders engaged in METIS

