Microelectronics and communication technology companies in Trøndelag

Invest in Norway (Innovation Norway)

Karabin Impello AS - Ragna Kristine Randeberg, Frode Iglebæk

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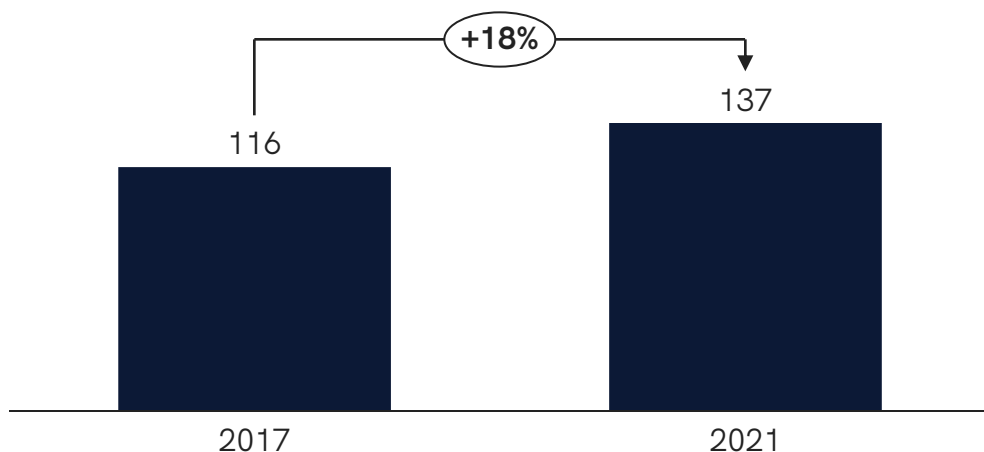Et selskap i Karabingruppen

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Summary

Micro electronics and communication technology (ME/CT) in Trøndelag

137 ME/CT companies in Trøndelag

4 399 employees

NOK 11.1 bn in total revenues in 2020

Number of ME/CT companies:

+18%

116 → 137

2017   2021

Categories and number of ME/CT companies

Categories

1	Development and sales of ASICs or related IP	11
2	Direct application of integrated circuits in own products, either by developing inhouse ASICs or using FPGA	14
3	Application of ready-made integrated circuits in self-developed hardware systems	47
4	Application of ready-made microprocessor hardware platform in combination with self-developed customized software	57
5	Other • Development/production of raw materials (2) • Manufacturing/assembly of products (2) • Service and competence providers (4)	8
Total		137

ASIC: Application Specific Integrated Circuits
FPGA: Field-Programmable Gate Arrays
IP: Intellectual Property

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1 Background

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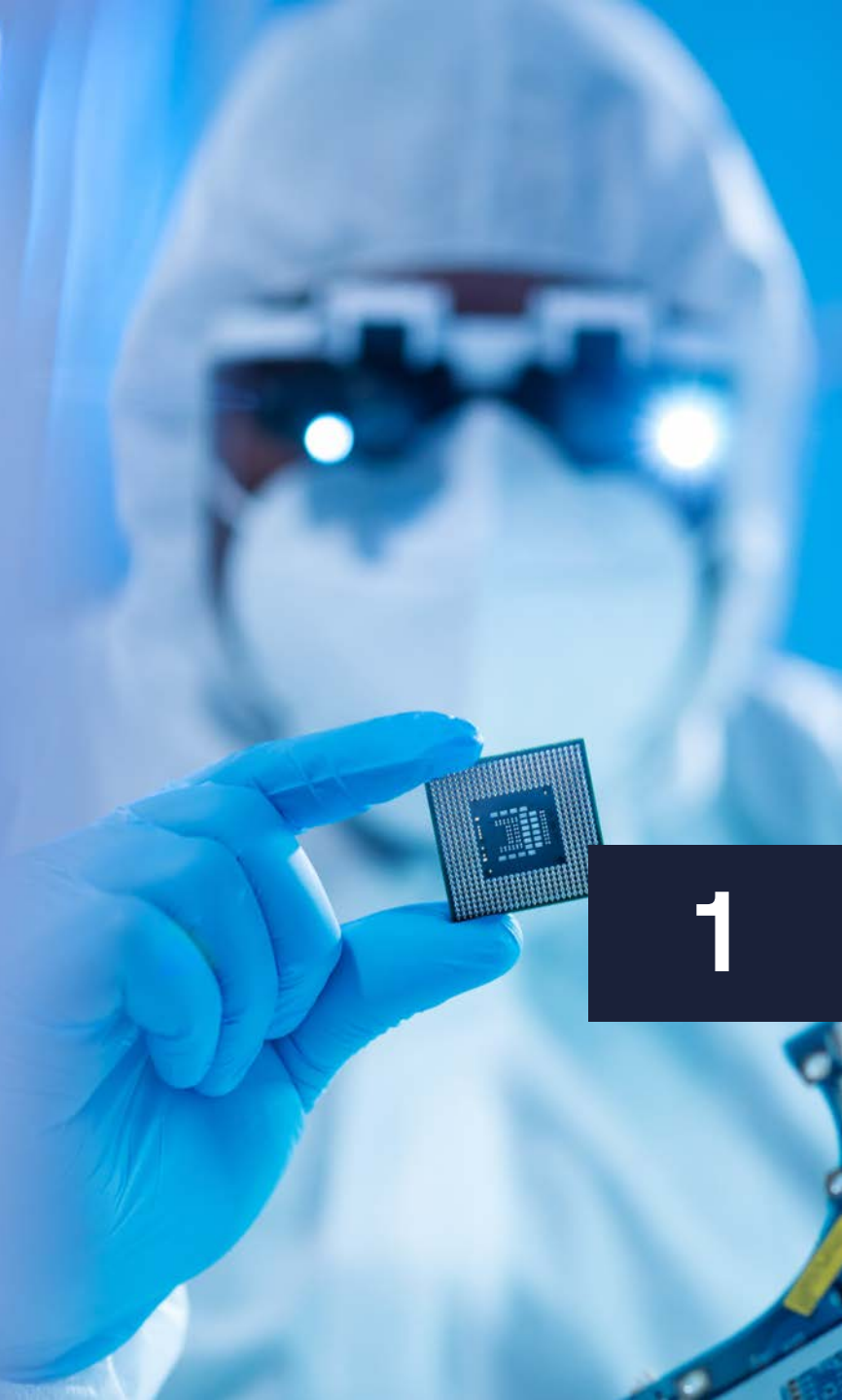
About the report

Background and objectives

- Trøndelag has a strong industry and ecosystem in Microelectronics (ME) and communication technology (CT). The objective of this report is to map and illustrate the variety of companies and competencies the region has to offer.
- Each year Impello publishes the 'Impello Analysis' of the technology companies in the Trondheim Region*.
- This study may serve as a starting point for a step-by-step approach to conducting a more extended analysis both regionally and nationally.

Method and content

- The report contains a list of the micro-electronics (ME) and communication technology (CT) companies in Trøndelag.
- The companies are screened and selected from Impello's database of 800+ technology companies in Trøndelag county.
- The companies considered as either a ME/CT company have been categorized in four main categories or 'levels'. See the description of the levels on next page.
- The report also contains analyses of financial figures of the ME/CT companies. All data are extracted from Proff Forvalt – a provider of financial company information.
- The definition of microelectronics and communication technology ME/CT is provided by Institute of electronics at NTNU – thanks to professor Per Gunnar Kjeldsberg.
- The categorization of the ME/CT companies is quality assured with industry professionals – thanks to Vegard Wollan and Gaute Myklebust in TouchNetix.

Title: Microelectronics and communication technology companies in Trøndelag

Client: Innovasjon Norge, Invest in Norway-Trøndelag

Authors: Ragna Kristine Randeberg, Frode Iglebæk

Project period: December 2021- January 2022

About Impello: Impello is a leading company in M&A, strategy and financial advisory. We give ambitious businesses direction, growth and increased value.

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Microelectronics is defined as the part of electronics that uses miniaturized electronic circuits

Definition of microelectronics and communications technology and categorization of Norwegian ME companies

The definition and level categorization is provided by Institute for electronic systems at NTNU. See Appendix 1 for the full-text description.

Definition: The part of electronics that uses miniaturized electronic circuits. These circuits, such as transistors of a size currently measured in nanometers, are then normally integrated in large numbers in a single chip and thus differ from the use of larger single components such as resistors and capacitors. Both integrated circuits and individual components are normally used together on circuit boards in electronic systems.

Norwegian microelectronics companies can be categorized in four main categories, or 'levels' :

Categories and levels

1. **Level 1:** Development and sales of ASICs or related IP
2. **Level 2:** Direct application of integrated circuits in own products, either by developing inhouse ASICs or using FPGA
3. **Level 3:** Application of ready-made integrated circuits in self-developed hardware systems
4. **Level 4:** Application of ready-made micro-processor hardware platform in combination with self-developed customized software

5. **Other**
   - Development/production of raw materials
   - Manufacturing/assembly of products
   - Service and competence providers

Levels

1. ASIC/IP development and sales
Includes companies that delivers IP, for example circuit data, to companies that design finished circuits.

2. IC/ASIC/FPGA direct application
Either by developing their own ASICs or using FGPAs.

3. IC application in self-developed hardware systems
Ready-made integrated circuits are mounted on self-developed circuit boards as part of a larger system. The system also often contains a microprocessor for which specially adapted software is developed.

4. Self-developed software on ready-made hardware platform
Uses a ready-made hardware platform with a microprocessor – writes customized software.
Broad category that includes many companies, *including communication technology*. These are traditionally not included in the microelectronics sector.

Note: See Appendix 2 for overview of terms and abbreviations
ASIC: Application Specific Integrated Circuits; **FPGA**: Field-Programmable Gate Arrays; **IP**: Intellectual Property

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2 The microelectronics and communication technology ecosystem in Trøndelag

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Microelectronics and communication technology companies in Trøndelag (1/2)

Raw materials
- Crayonano AS
- Wacker Chemicals Norway AS

Manufacturing and assembly
- Inission Løkken
- Norbit EMS

Service and competence providers
- Bitreactive AS
- CPS AS
- Force Technology Norway AS avd. Trondheim
- Kodeworks Trondheim AS

1. ASIC/IP development and sales
- Arm Norway AS
- Edatek AS
- Microchip Technology Norway AS
- Midcom Trondheim AS
- Nordic Semiconductor ASA
- Novelda AS avd. Trondheim
- Skaland PCB Design AS
- TouchNetix AS
- Verranto AS

2. Direct application of integrated circuits in own products, either by developing inhouse ASICs or using FPGA
- Aurotech Ultrasound AS
- Garmsmia AS
- Inventas AS
- Kongsberg Seatex AS
- Minoko Design AS
- Norbit Aptomar AS
- Norbit ITS AS
- Norbit ODM AS
- Norbit Subsea AS
- Norwegian Creations AS
- Scandinavian Tooling & Production AS
- STP Technology AS
- Tecnec Electronics AS
- Zolve AS

3. Application of ready-made integrated circuits in self-developed hardware systems
- Anicare Tech AS
- Aquasonics AS
- Autronica Fire And Security AS
- Aziwell AS
- Briks AS
- Cimon Medical AS
- Daal Noise Control Systems AS
- Defa AS avd. Trondheim
- Devico AS
- Elektro Utvikling AS
- Elotec AS
- Eltorque AS
- El-Watch AS
- GE Vingmed Ultrasound AS avd. Trondheim
- Heatexp AS
- Indusenz AS
- Inphase Solutions AS
- Integrated Optoelectronics AS
- Interwell Norway AS avd. Trondheim
- Kontur AS
- Lilbit Odm AS
- Mode Sensors AS
- Nordiq Products AS
- Nortroll AS
- Ntention Extended Utility Solutions AS
- Optoscale AS
- Panoptes
- Q-Free ASA
- Q-Tagg R&D AS
- Roxar AS avd. Trondheim
- Scout Drone Inspection AS
- Sealab AS
- Sensor Innovation
- Sensorlink Subsea AS
- Sentisystems AS
- Sevendof AS
- Siemens AS avd. Building Technologies Trondheim
- Siemens AS avd. Energy Management
- Siemens AS avd. Process Industries and Drives
- Siemens AS avd. Subsea Trondheim
- Skynordic AS avd. Trondheim
- Snowflake AS
- Submerged AS
- Tech Norway AS
- Thelma Biotel AS
- Ubiq Aerospace AS
- Zmartedge AS

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Microelectronics and communication technology companies in Trøndelag (2/2)

4. Application of ready-made microprocessor hardware platform in combination with self-developed customized software

- Alcatel Submarine Networks Norway AS
- Amparo Solutions AS
- Anteo AS
- APX Systems AS avd. Oppdal
- Augmenti AS
- Baker Hughes GE Trondheim VGSAS
- Blueye Robotics AS
- Breach Reality AS
- Brewbuddy AS
- Cargosafe Systems AS
- Cavotec Micro-Control AS
- Conoptica AS
- Ctm Lyng AS
- Devinco AS
- Digital Innovation AS
- Dtecto AS
- Eelume AS
- Fara AS
- Ferrx AS

- Flying Foil AS
- Fugro Norway AS avd. Trondheim
- Geneseque AS
- Greenfox Marine AS
- Hansen Technologies Norway AS avd. Trondheim
- Hark Technologies AS
- Initial Force AS
- Kongsberg Digital AS avd. Trondheim
- Maritime Robotics AS
- Nisonic AS
- Ocean Access AS
- Ocean Space Acoustics AS
- Ocein AS avd. Klæbu
- Olex AS
- Precision Navigation AS
- Radionor Communications AS
- Realtimeid AS
- Safebase AS
- Safedrive AS

- Seabed Geosolutions AS avd. Trondheim
- Sikom AS
- Sikom Connect AS
- Skorstad Engineering AS
- Smartbells AS
- Smarthelp AS
- Systor International AS
- Systor Trondheim AS
- Telenor Digital AS avd. Trondheim
- Telenor Inpli AS avd. Trondheim
- Thales Norway AS avd. Trondheim
- TTA AS
- Vision Remote AS
- Vitacon AS
- Water Linked AS
- Widril AS
- Wins Geo AS
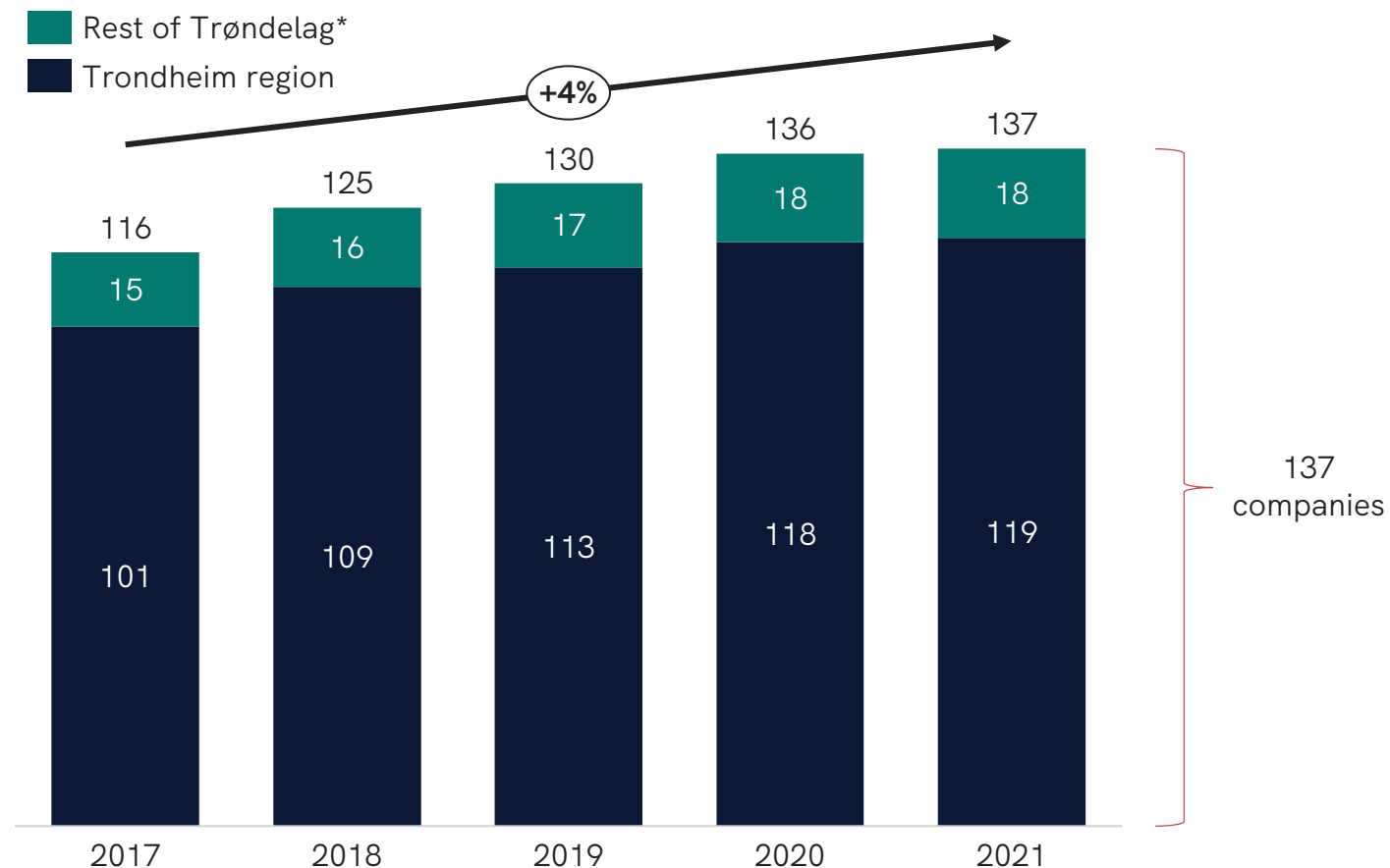- Wireless Instrumentation Systems AS
- Xtronica AS

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3 Key figures: ME/CT in Trøndelag

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The ME/CT ecosystem is growing steadily 4% per year – dominated by category 3 and 4
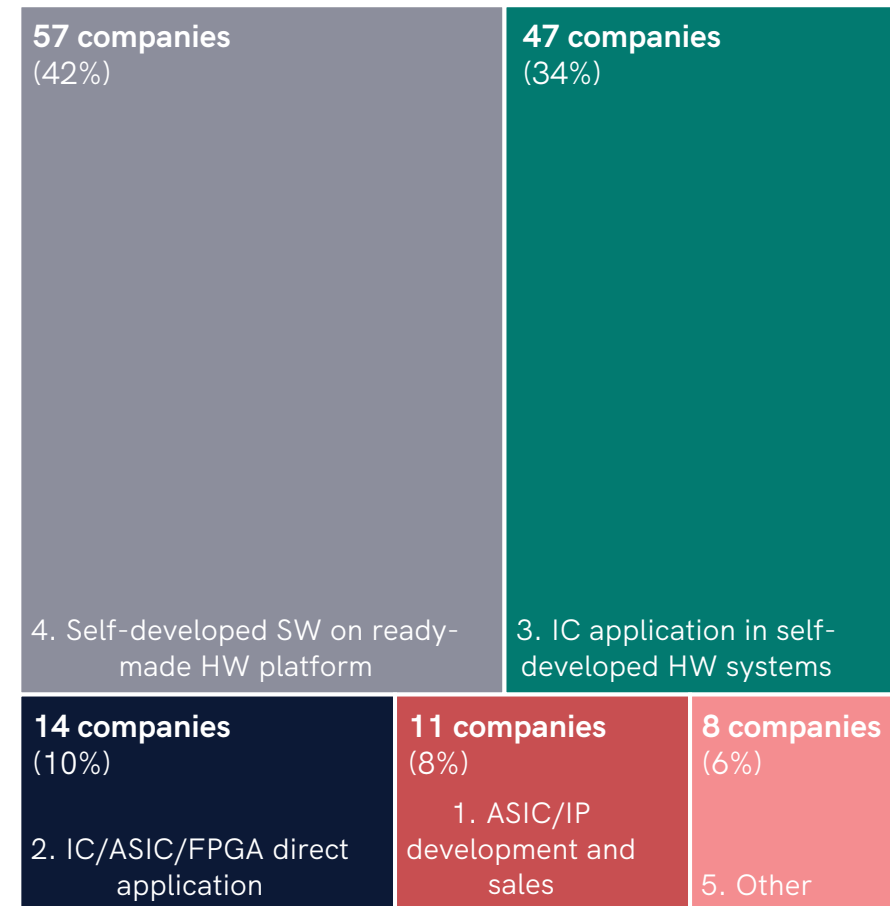
Number of ME/CT companies 2017-2021

Historical data only available for the Trondheim region.* Estimate for rest of Trøndelag (2017-2020) based on the ratio between companies in the Trondheim region and outside (2021). Compound annual growth rate = 4 %.

■ Rest of Trøndelag*
■ Trondheim region

+4%

Year	Rest of Trøndelag*	Trondheim region	Total
2017	15	101	116
2018	16	109	125
2019	17	113	130
2020	18	118	136
2021	18	119	137

137 companies

Distribution of companies within each category (2022)

Category '5. Other' includes raw materials, manufacturing/assembly and service and competence providers.

57 companies (42%)
4. Self-developed SW on ready-made HW platform

47 companies (34%)
3. IC application in self-developed HW systems

14 companies (10%)
2. IC/ASIC/FPGA direct application

11 companies (8%)
1. ASIC/IP development and sales

8 companies (6%)
5. Other

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The companies that develop and sell ASICs and those who directly apply them are large and important employers in the region – despite not being many in number

Employees within each category

Total number of employees within each category per 26th of January 2022.

- 1. ASIC/IP development and sales
- 2. IC/ASIC/FPGA direct application
- 3. IC application in self-developed HW systems
- 4. Self-developed SW on ready-made HW platform
- 5.1 Materials
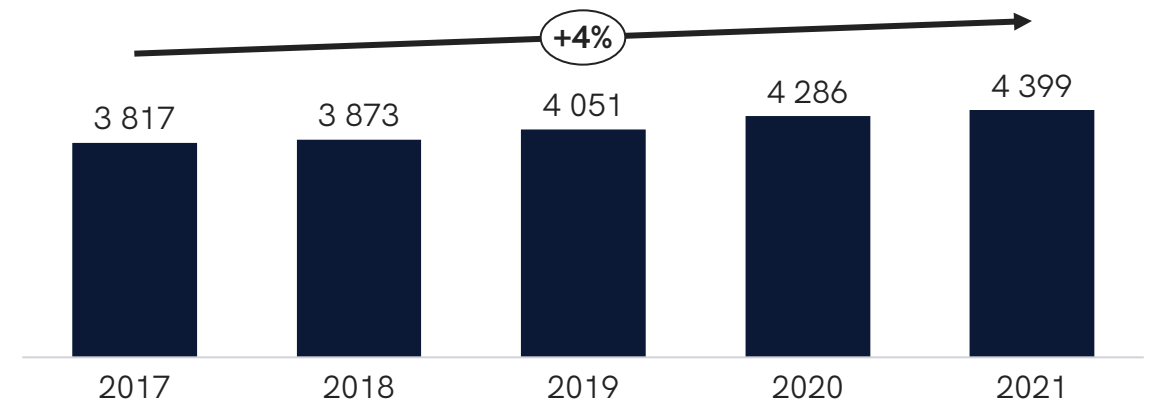- 5.2 Production and assembly
- 5.3 Service providers

Pie chart values:
- 907 (23%)
- 580 (15%)
- 1 191 (30%)
- 798 (20%)
- 261 (7%)
- 192 (5%)
- 64 (2%)
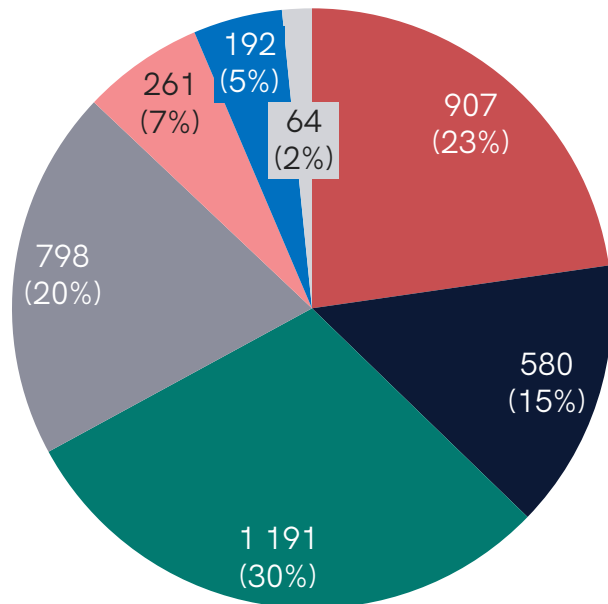
Largest employers (January 2022) – all categories

Company	Employees
Nordic Semiconductor ASA	571
Autronica Fire and Security AS	333
Siemens AS avd. Process Industries And Drives	277
Wacker Chemicals Norway AS	231
Arm Norway AS	190
Kongsberg Maritime AS avd. Skonnertvegen	158
Kongsberg Seatex AS	138
Inventas AS	125
Microchip Technology Norway AS	122
Norbit EMS AS	120

Development in total number employees in ME/CT companies 2017-2021

CAGR – Compound annual growth rate = 4%.

+4%

2017	2018	2019	2020	2021
3 817	3 873	4 051	4 286	4 399

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# Strong revenue growth (+ 9% per year) - but with varying profitability

Total operating revenues for ME/CT companies (2011-2020)

Revenue figures for limited companies only, financial figures for subdivisions not available. Operating revenues in [MNOK]. Compound annual growth rate = 9%.

Operating revenues [MNOK]
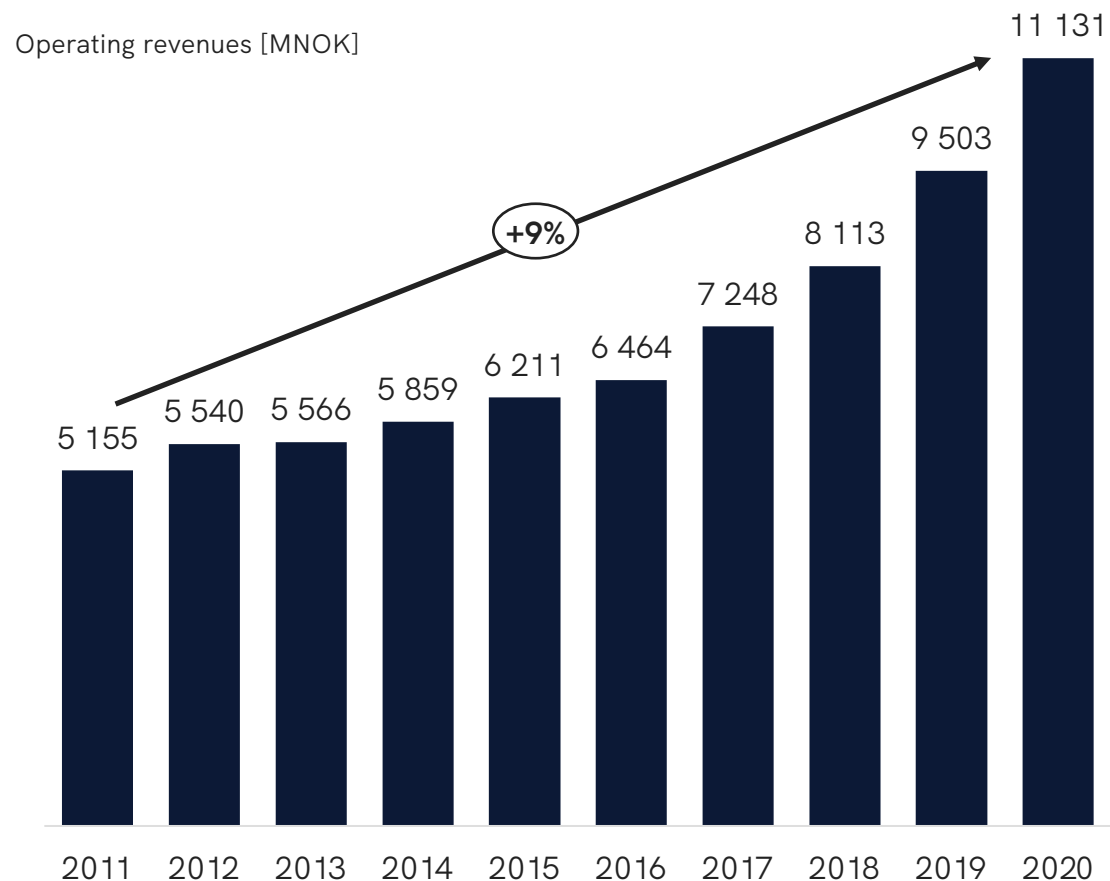
Total operating profit and margin (2011-2020)

Figures for limited companies only, financial figures for subdivisions not available. Operating revenues in [MNOK] and operating margin in [%].
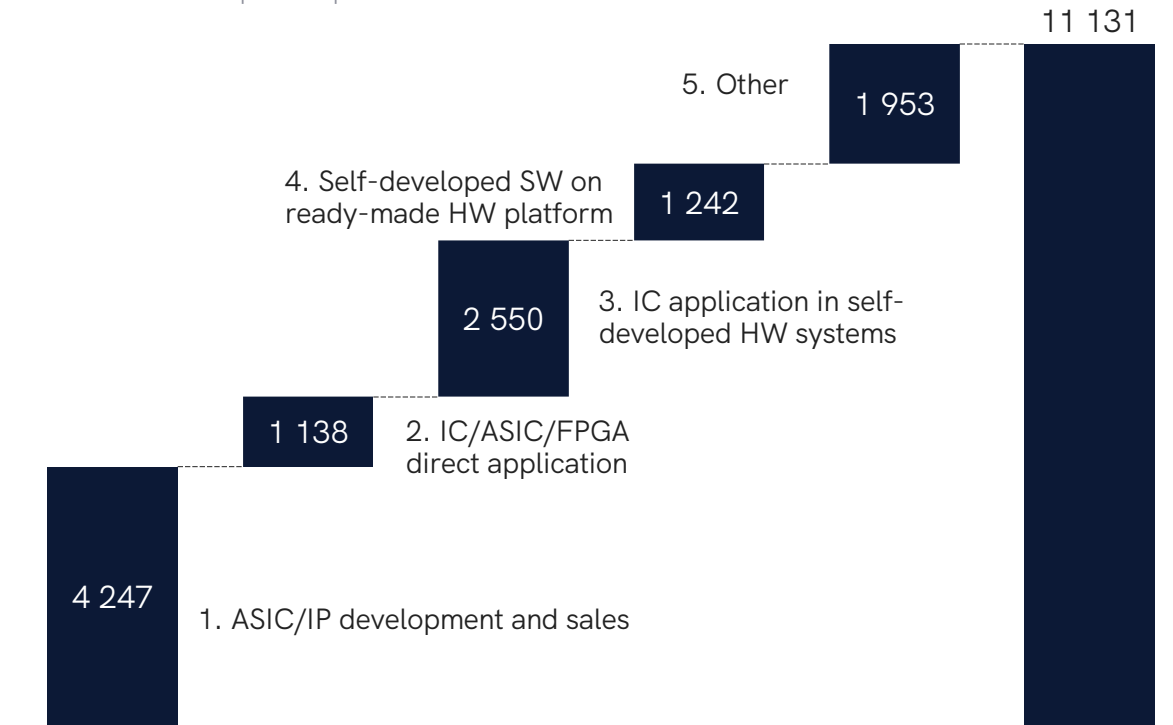

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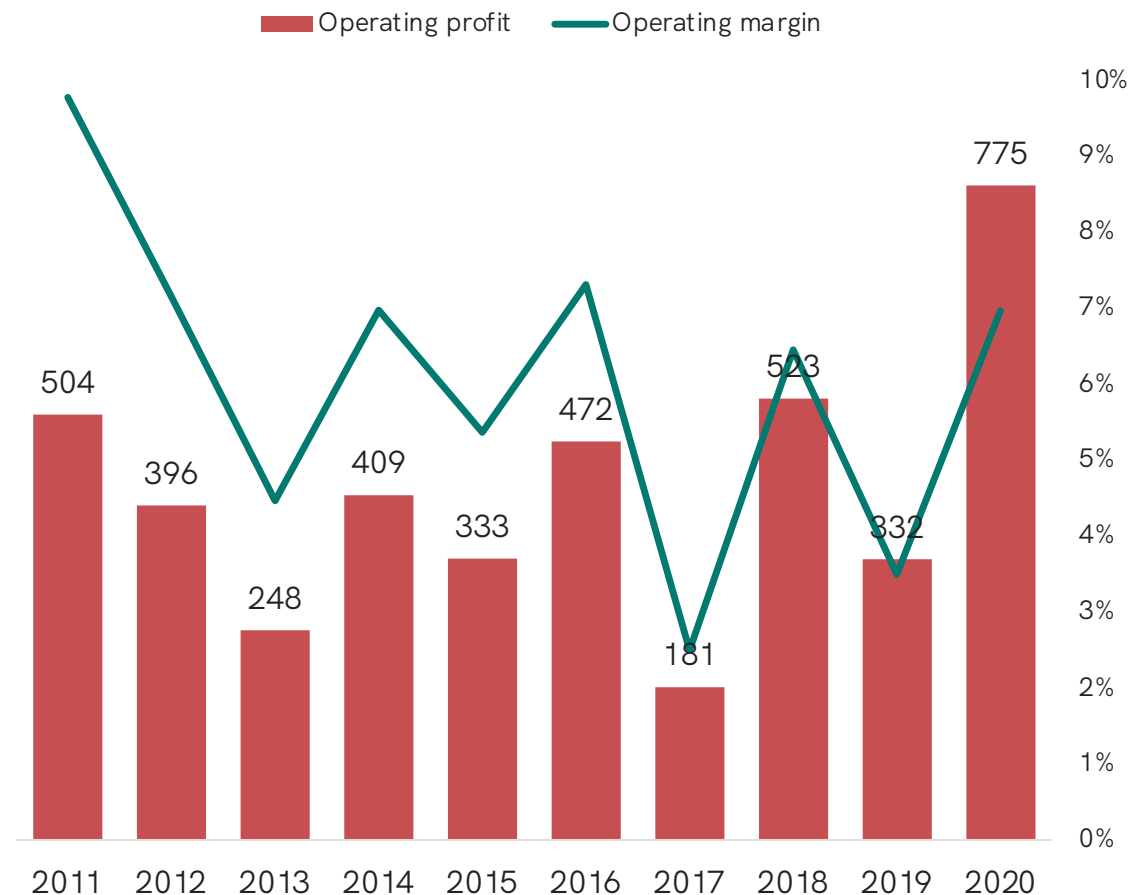
Category 1 makes up a small proportion of companies – but accounts for a large part of total revenues

Revenue distribution per category (2020)

Operating revenues in [MNOK]. Category '5. Other' includes raw materials, manufacturing/assembly and service and competence providers.

## Revenues per category (2016-2020)

Operating revenues in [MNOK]. 5 year growth 2016-2020 and 1 year growth 2019-2020 in [%].

Category	2016	2019	2020	5 yr	1 yr
1. ASIC/IP development and sales	1 768	2 940	4 247	140%	44%
2. IC/ASIC/FPGA direct application	702	1 201	1 138	62%	-5%
3. IC application in self-developed HW systems	2 136	2 548	2 550	19%	0%
4. Self-developed SW on ready-made HW platform	701	1 256	1 242	77%	-1%
5. Other					
Materials	842	1 050	1 441	71%	37%
Production and assembly	311	485	495	59%	2%
Service providers	0.9	20	17	1 658%	-15%

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Category 1: ASIC/IP development and sales

Operating revenues 2016-2020

Total operating revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 1: Development and sales of ASICs or related IP.
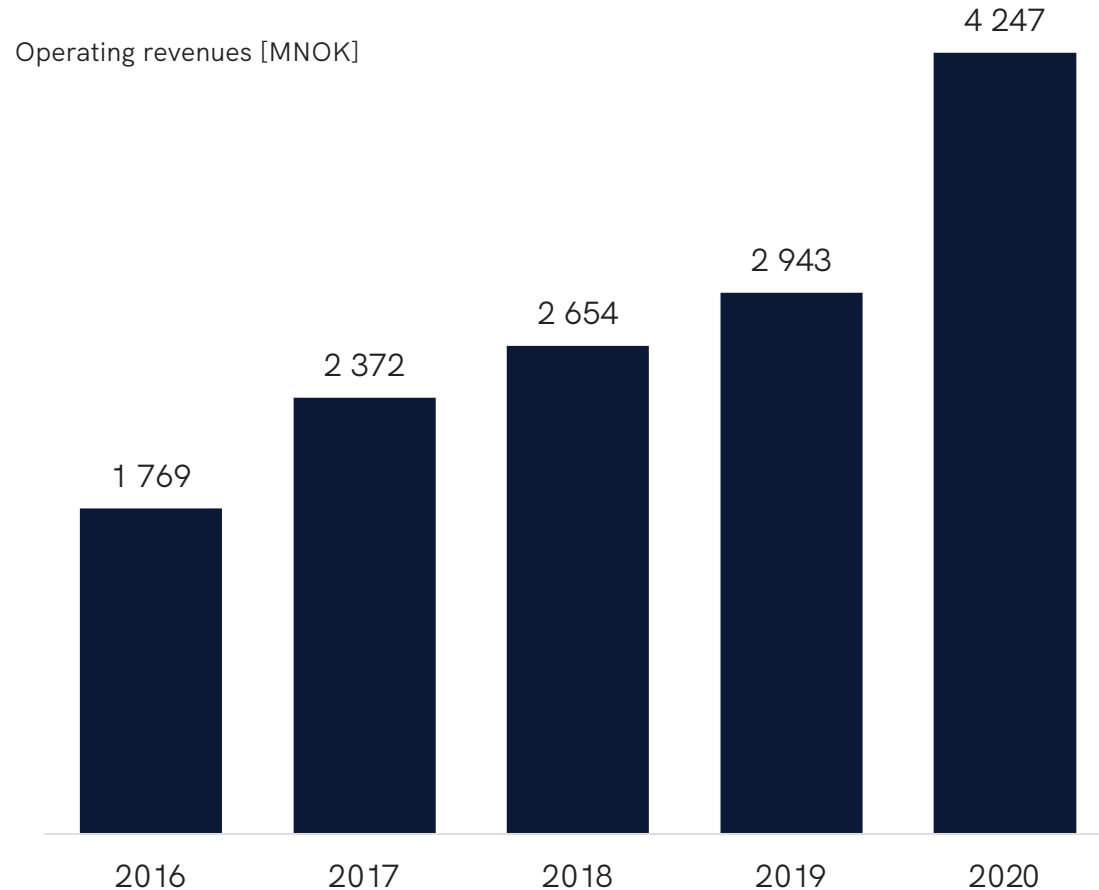
Operating revenues [MNOK]

Year	Revenue
2016	1 769
2017	2 372
2018	2 654
2019	2 943
2020	4 247

Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Nordic Semiconductor ASA	3 809.0
Arm Norway AS	269.2
Microchip Technology Norway AS	145.0
Touchnetix AS	16.1
Ablepay Technologies AS	2.5
Verranto AS	1.7
Midcom Trondheim AS	1.5
Edatek AS	1.2
Skaland PCB Design AS	0.1

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Category 2: IC/ASIC/FPGA direct application

Operating revenues 2016-2020

Total operating revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 2: Direct application of integrated circuits in own products, either by developing inhouse ASICs or using FPGA.

Operating revenues [MNOK]
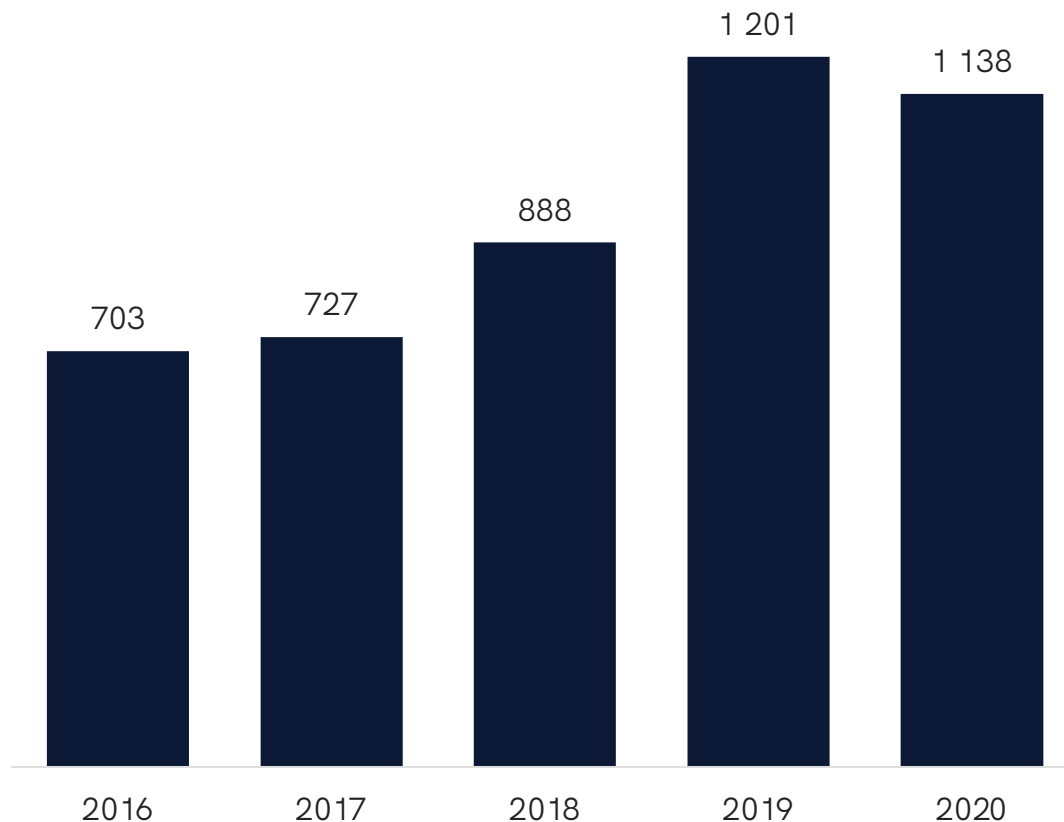
| Year	Value
2016	703
2017	727
2018	888
2019	1 201
2020	1 138

Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Kongsberg Seatex AS	442.4
Norbit Subsea AS	217.7
Norbit ITS AS	145.1
Inventas AS	131.1
Scandinavian Tooling & Production AS	50.8
Norbit Aptomar AS	49.5
Norbit ODM AS	47.6
Aurotech Ultrasound AS	24.5
Zolve AS	9.9

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Category 3: IC application in self-developed HW systems

Operating revenues 2016-2020

Total operating revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 3: IC application in self-developed HW systems.
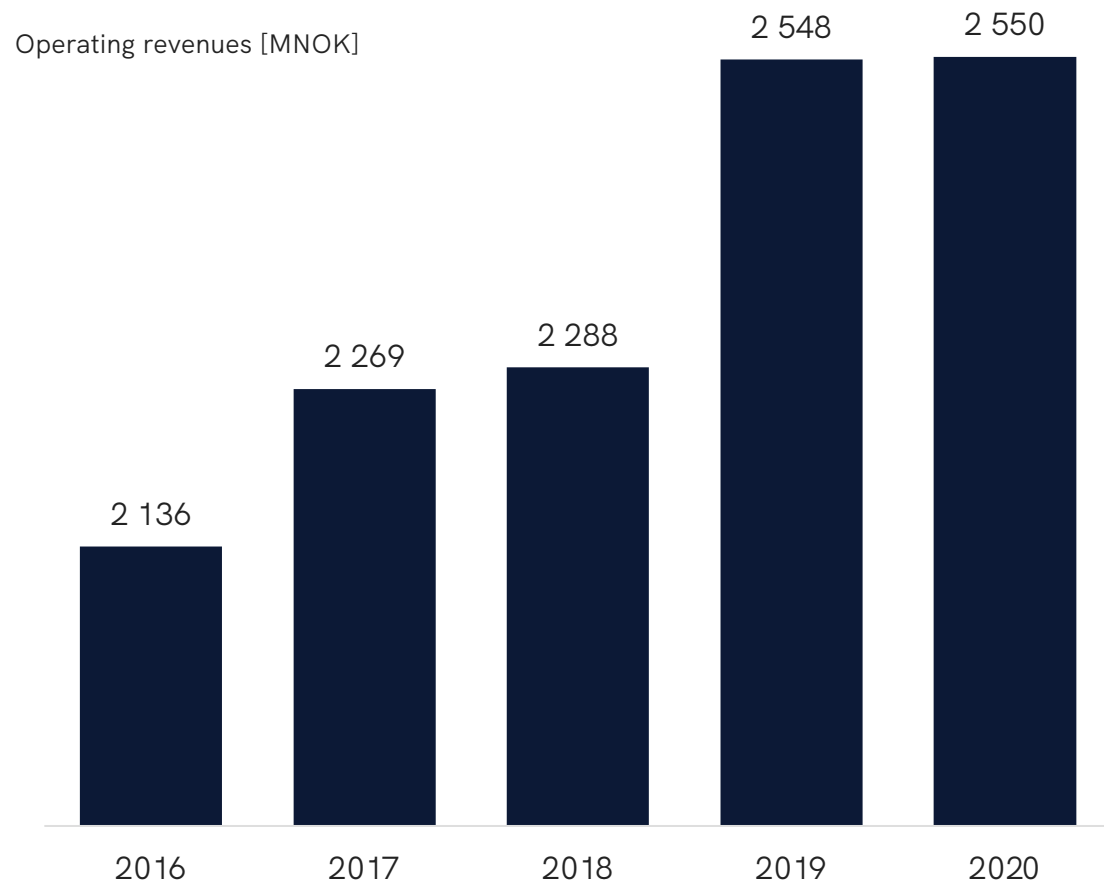
Operating revenues [MNOK]

Year	Revenue
2016	2 136
2017	2 269
2018	2 288
2019	2 548
2020	2 550

Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Q-Free ASA	889.3
Autronica Fire And Security AS	861.8
Devico AS	210.7
Elotec AS	172.3
Eltorque AS	147.2
Sensorlink Subsea AS	72.6
Nortroll AS	51.9
Kontur AS	34.4
Aziwell AS	20.2
Thelma Biotel AS	14.3

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Category 4: – application of ready-made hardware, writes customized software

Operating revenues 2016-2020

Total operating revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 4: Application of ready-made hardware, writes customized software.

Operating revenues [MNOK]

Year	Value
2016	701
2017	770
2018	1 065
2019	1 256
2020	1 242
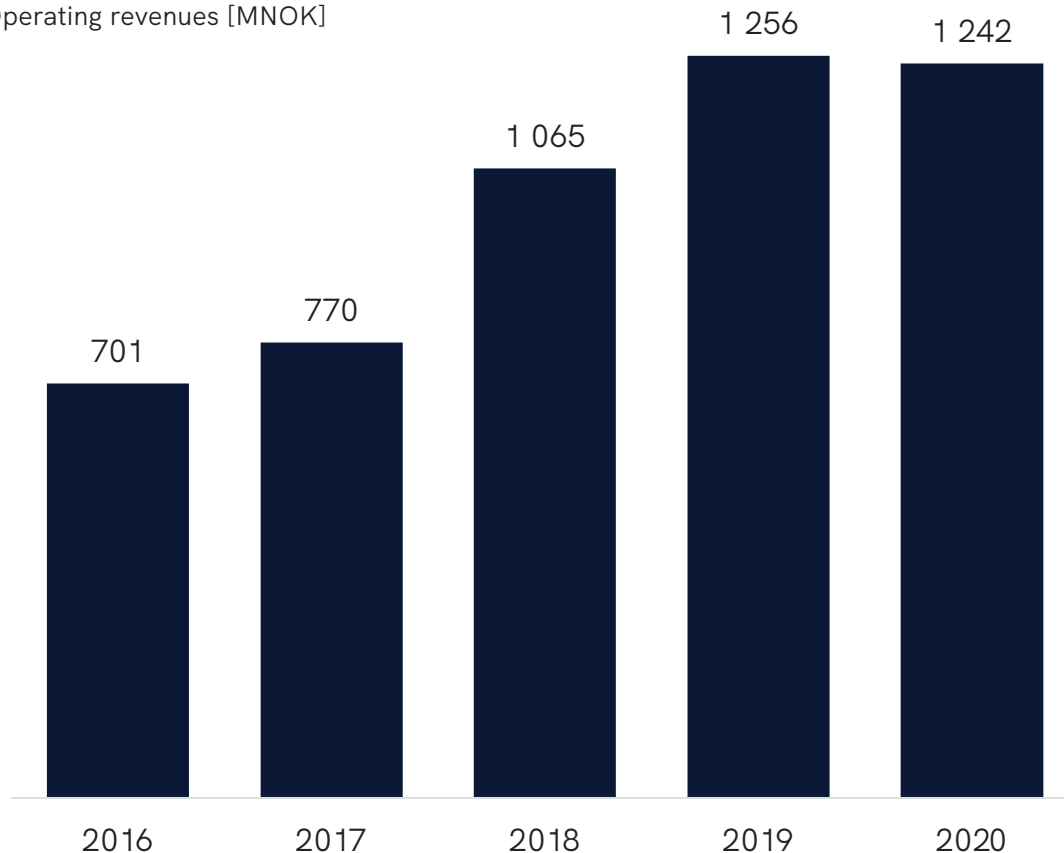
Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Fara AS	207.7
Ctm Lyng AS	165.5
Alcatel Submarine Networks Norway AS	129.6
Systor Trondheim AS	98.1
Cavotec Micro-Control AS	93.2
Devinco AS	87.2
Safedrive AS	51.7
Maritime Robotics AS	51.1
Radionor Communications AS	47.2
Safebase AS	36.2

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Category 5: Raw materials, manufacturing/assembly and service/competence

Operating revenues 2016-2020

Total operating revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 5: Raw materials, manufacturing/assembly and service/competence.

Operating revenues [MNOK]
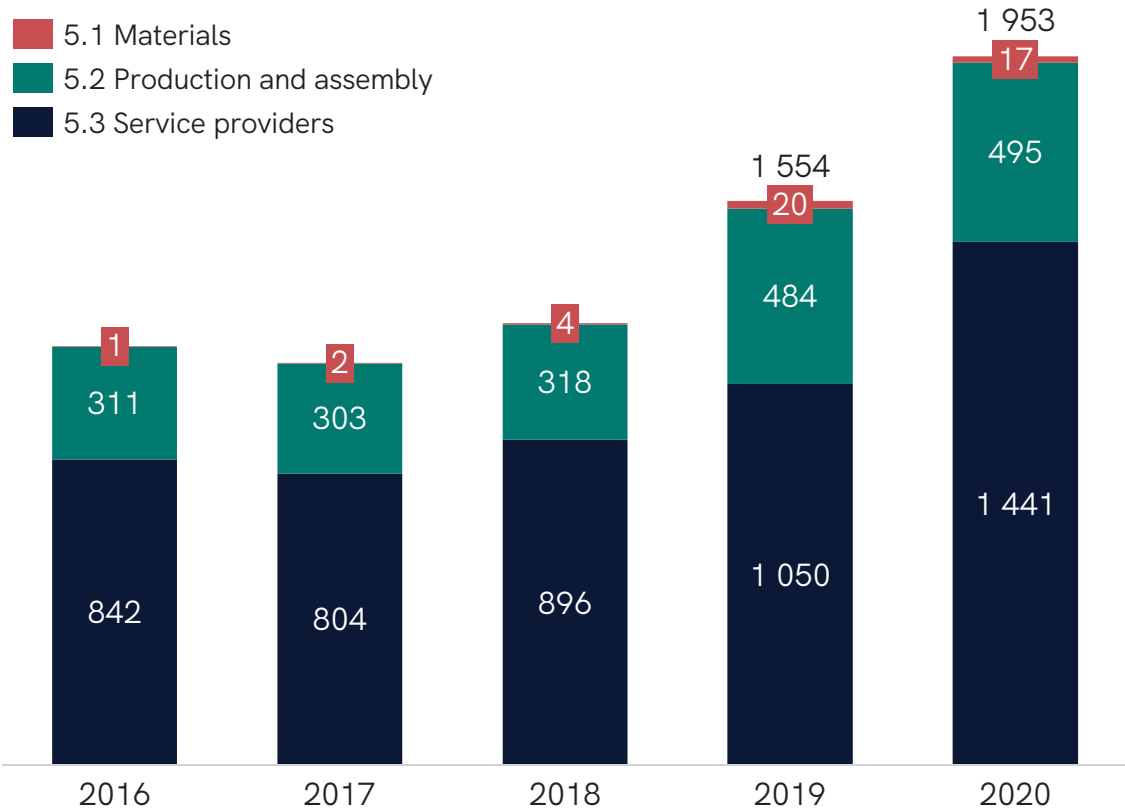

Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Wacker Chemicals Norway AS	1 439.1
Norbit EMS AS	307.5
Inission Løkken AS	187.7
Kodeworks Trondheim AS	13.1
CPS AS	4.0
Crayonano AS	2.1
Bitreactive AS	-

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Category: 5 – Raw materials, manufacturing/assembly and service/competence
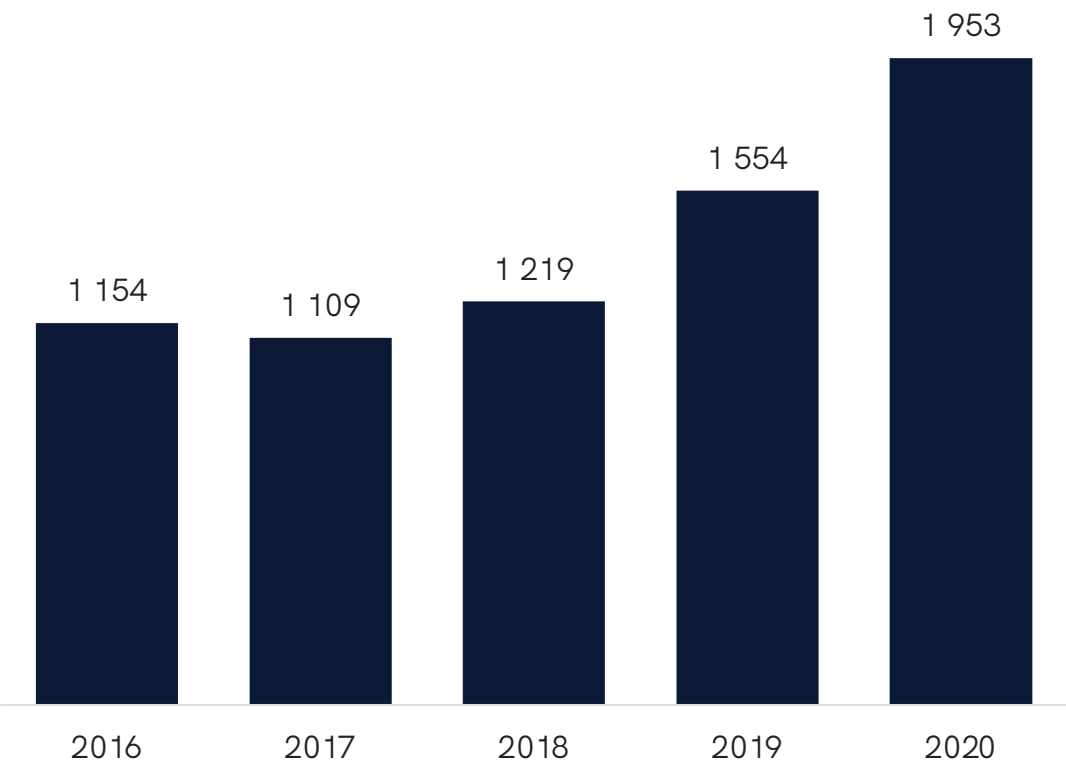
Operating revenues 2016-2020

Revenues in [MNOK] for microelectronics and communication technology companies in the Trondheim Region, Category 5 – Raw materials, manufacturing/assembly and service/competence.

- 5.1 Materials
- 5.2 Production and assembly
- 5.3 Service providers

Largest companies based on revenues 2020

Operating revenues in [MNOK].

Company	Revenues 2020
Wacker Chemicals Norway AS	1 439.1
Norbit EMS AS	307.5
Inission Løkken AS	187.7
Kodeworks Trondheim AS	13.1
CPS AS	4.0
Crayonano AS	2.1
Bitreactive AS	-
Force Technology Norway AS avd. Trondheim	-

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4 Appendix

Explanation of the categories

Level-categorization is prepared by Professor Kjeldsberg at Institute for electronic systems at NTNU, definitions may vary between different scholars.

- **Step 1: Development and sale of ASIC (+ IP related to this)**

If we are to talk about the Norwegian microelectronics industry based on the definition of microelectronics (page 5), then this will be limited to the companies that currently work with development and sale of customer-specified integrated circuits, often also referred to as Application Specific Integrated Circuits (ASIC). There are many of these, and Nordic Semiconductor, Microchip, Silicon Labs, Texas Instruments, Disruptive Technologies, Sony, Integrated Detector Electronics and TouchNetix are good examples of such companies. A company such as ARM Norway does not design integrated circuits itself but delivers circuit data in the form of so-called IP (Intellectual Property) to companies that design finished circuits. It is therefore natural to include them according to this definition.

- **Step 2: Direct application of integrated circuits (ASIC / FPGA)**

However, it is also natural to extend the definition of who is part of the microelectronics industry to include companies that directly use integrated circuits in their products. This group includes those who develop ASICs for their own products and those who use so-called "Field Programmable Gate Arrays" (FPGA). An FPGA is a ready-made circuit that can be coded to a specific hardware function and where the coding requires many of the same design steps as integrated circuits. These can then be mounted on circuit boards in the same way as other circuits. Various departments in the Kongsberg Group use their own ASIC and FPGA to a large extent in their products. Companies such as Dataresponse, Cisco, Inventas, Norbit, EmLogic, Eidel, and many more, use FPGAs in their products or develop FPGA solutions that their customers again use in their products.

- **Step 3: Application of ready-made integrated circuits in a self-developed system**

The next step is to include companies that use ready-made integrated circuits, for example for wireless communication provided by Nordic Semiconductor, in their products. These are then usually mounted on self-developed circuit boards, as part of a larger system. The system often also contains a microprocessor for which specially adapted software is developed. With this extension of the definition, the number of companies is also significantly expanded, not least in the form of start-up companies. Examples here are Mode Sensors, Sensor Innovation and 3D Radar. In this case, it will probably vary whether the companies define themselves as part of the microelectronics industry or pure electronics industry.

- **Step 4: Uses ready-made hardware platform - writes custom software**

The next step may be companies that use a ready-made hardware platform with a microprocessor, for which specially adapted software is then written. However, these companies are not normally considered as part of the microelectronics industry. To the extent that the definition should also include companies in the field of communication technology, many of them will use such solutions. For example, Telenor is a communications technology company, even though they mainly buy ready-made electronics systems that they make available to end users, for example in the form of a mobile telephony service.

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Explanation of the categories (in Norwegian)

Level-categorization is prepared by Professor Kjeldsberg at Institute for electronic systems at NTNU, definitions may vary between different scholars.

- **Trinn 1: Utvikling og salg av ASIC (+IP knyttet til dette)**

Hvis vi ut fra denne definisjonen skal snakke om den norske mikroelektronikkindustrien, så vil dette begrense seg til de bedriftene som i dag arbeider med utvikling og salg av kundespesifiserte integrerte kretser, gjerne også omtalt som Application Specific Integrated Circuits (ASIC). Disse finnes det mange av, og Nordic Semiconductor, Microchip, Silicon Labs (oslo), Texas Instruments (oslo), Disruptive Technologies (oslo), Sony (oslo), Integrated Detector Electronics (oslo) og TouchNetix, er gode eksempler på slike selskap. Et selskap som ARM Norway designer ikke selv integrerte kretser, men leverer kretsunderlag i form av såkalt IP (Intellectual Property) til bedrifter som designer ferdige kretser. Det er følgelig naturlig å også inkludere dem etter denne definisjonen.

- **Trinn 2: Direkte anvendelse av integrerte kretser (ASIC/FPGA)**

Det er imidlertid også naturlig å utvide definisjonen av hvem som er en del av mikroelektronikkindustrien til å inkludere bedrifter som direkte anvender integrerte kretser i sine produkter. Det første trinnet her er de som utvikler egne ASIC for sine egne produkter og de som anvender såkalte «Field Programmable Gate Arrays» (FPGA). En FPGA er en ferdig produsert krets som kan kodes til en spesifikk maskinvarefunksjon og der kodingen krever mange av de samme designtrinnene som integrerte kretser. Disse kan så monteres på kretskort på samme måte som en andre kretser. Ulike avdelinger i Kongsberggruppen bruker egne ASIC og FPGA i stor grad i sine produkter. Selskap som Datarespons (viken), Cisco (viken), Inventas, Norbit, EmLogic (viken), Eidel (viken), med mange flere, benytter FPGA i sine produkter eller

utvikler FPGA løsninger som deres kunder igjen bruker i sine produkter.

- **Trinn 3: Anvendelse av ferdige integrerte kretser i egenutviklet system**

Det neste trinnet er å inkludere bedrifter som benytter ferdige integrerte kretser, for eksempel for trådløs kommunikasjon levert av Nordic Semiconductor, i sine produkter. Disse monteres da gjerne på egenutviklede kretskort, som en del av et større system. Systemet inneholder ofte også en mikroprosessor som det utvikles spesialtilpasset programvare for. Med denne utvidelsen av definisjonen utvides også antall bedrifter vesentlig, ikke minst i form av oppstartsbedrifter. Eksempler her er Mode Sensors, Sensor Innovation og 3D Radar. Her vil det nok variere hvorvidt bedriftene definerer seg selv som mikroelektronikkindustri eller ren elektronikkindustri.

- **Trinn 4: Anvender ferdig maskinvareplattform - skriver spesialtilpasset programvare**

Neste trinn kan være bedrifter som benytter en ferdig maskinvareplattform med mikroprosessor, som det deretter skrives spesialtilpasset programvare for. Disse bedriftene vil imidlertid normalt ikke regnes som del av mikroelektronikkindustrien. I den grad definisjonen også skal omfatte bedrifter innen fagområdet kommunikasjonsteknologi, så vil imidlertid mange av dem benytte slike løsninger. Da kan man også gå helt til toppen av næringskjeden, der for eksempel Telenor er en kommunikasjonsteknologibedrift selv om de i all hovedsak kjøper ferdige elektronikksystemer som de gjør tilgjengelig til sluttbrukere, for eksempel i form av en mobiltelefonitjeneste.

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Terms and abbreviations

- ASIC: Application-Specific Integrated Circuit is an integrated circuit chip that has been designed for a specific purpose. In other words, optimized to compute a single or a set of related functions.
- FPGA: A Field-Programmable Gate Array is a ready-made circuit that can be coded to a specific hardware function and where the coding requires many of the same design steps as integrated circuits. These can then be mounted on circuit boards in the same way as other circuits.
- IP: Intellectual property
- ME: Microelectronics
- CT: Communications technology

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