EUROPEAN EMS TOUR 2022

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TOUR OVERVIEW

- Dieter Weiss of in4ma and Eric Miscoll of EMSNOW conducted their second tour of European based EMS companies.
- The tour began on October 29, 2022 when they met up in Frankfurt, Germany
- The tour ended on November 17, 2022 when both left Munich, Eric for his home in Texas, and Dieter to make another industry presentation for the InCap Capital Markets Day in Helsinki, Finland.
- The tour encompassed visits to 15 EMS company facilities in 5 countries (Sweden, France, Belgium, The Netherlands, and Germany).
- The tour covered about 4500 kilometers by car, plus flights to and from Scandinavia.
- During the tour, they recorded 13 podcasts, conducted one video discussion on the French EMS market, and appeared on one video interview with Phil Stoten of SCOOP about the Swedish EMS market.
- The last two days of the tour were at the Electronica Trade Fair in Munich, Germany where they met with many more EMS companies and conducted video interviews with senior executives from four European based EMS companies (Inission, Katek Group, Neways, and Zollner).
- All podcasts and video interviews are available on www.EMSNOW.com

EMS Companies Visited: (listed in order visited):

- Enics, now part of GPV Group
- Kitron
- Inission
- Orbit One
- Scanfil
- Asteelflash
- Lacroix Electronics
- All Circuits
- C-MAC
- VDL TBP Electronics
- Prodrive Technologies
- Coronex EMS
- Fritsch Elektronik
- BDT (Bavaria Digital Technik)
- Katek Mauerstetten

A profile of each EMS company can be found on EMSNOW.com under the EMS Profiles tab.

Tour Sponsors

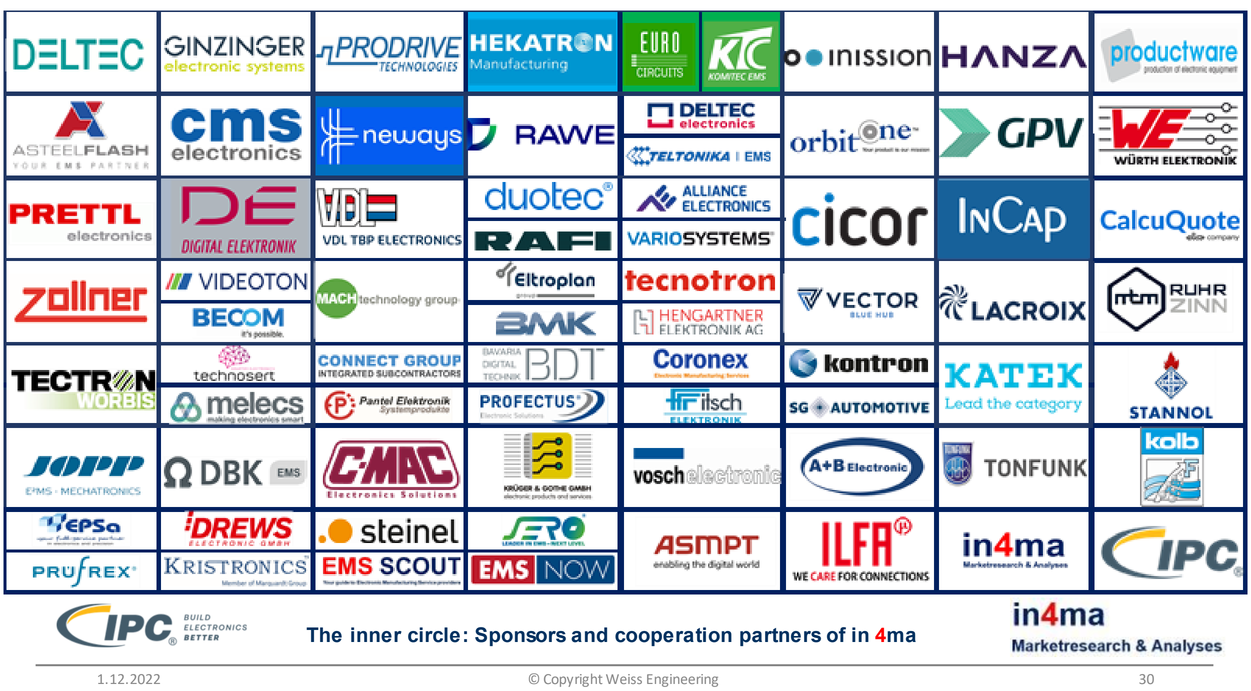
EMSNOW wishes to thank this year's tour sponsors. Their support allowed us to conduct this tour and provide our insights on the European EMS industry.

CalcuQuote, *a software solutions partner for the electronics industry*

Cogiscan – *the factory digitalization partner for electronics manufacturers Globally*

Mycronic – *global supplier of high flexibility production equipment*

in4ma thanks their sponsors as well for their continued support of our work to make electronics market data better.



IN4MA DATA

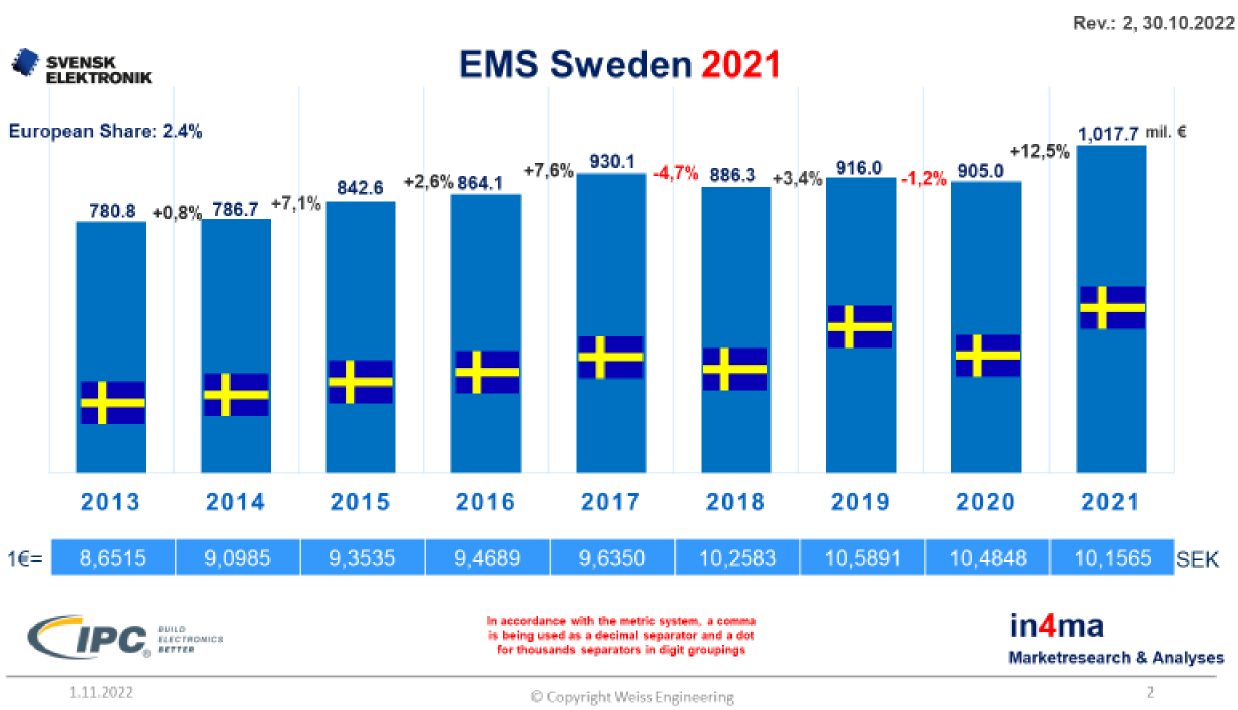
The following data sets are provided by Dieter Weiss of in4ma. At each EMS company we toured, Dieter shared some select market research for the country/region we were visiting. This data was always the basis for great conversations about the EMS industry in the specific region.

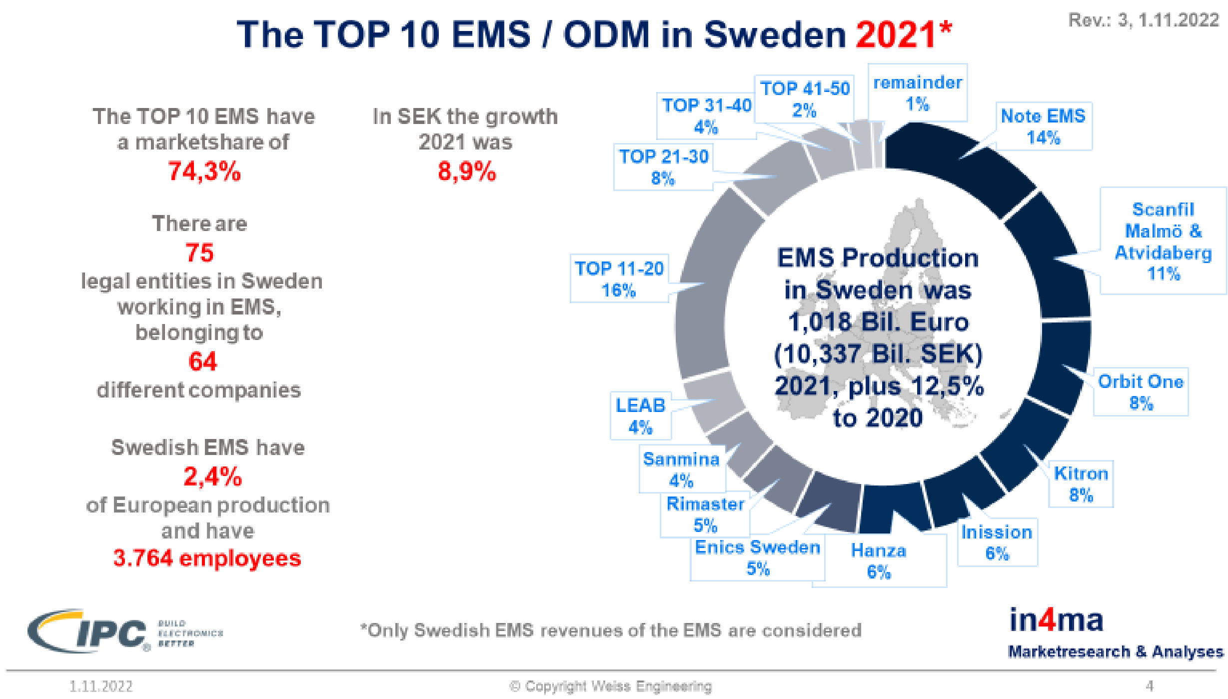
The data sets are presented in order of the regions we toured, and do not represent the full set of data slides presented on the tour.

We encourage anyone who is interested in a more comprehensive understanding of the European EMS industry to reach out to in4ma and purchase their most recent EMS industry report or become a sponsor of the in4ma work. They truly do produce the best and most comprehensive market research on the European EMS industry based on a deep understanding of the industry and the companies involved. (www.in4ma.de)

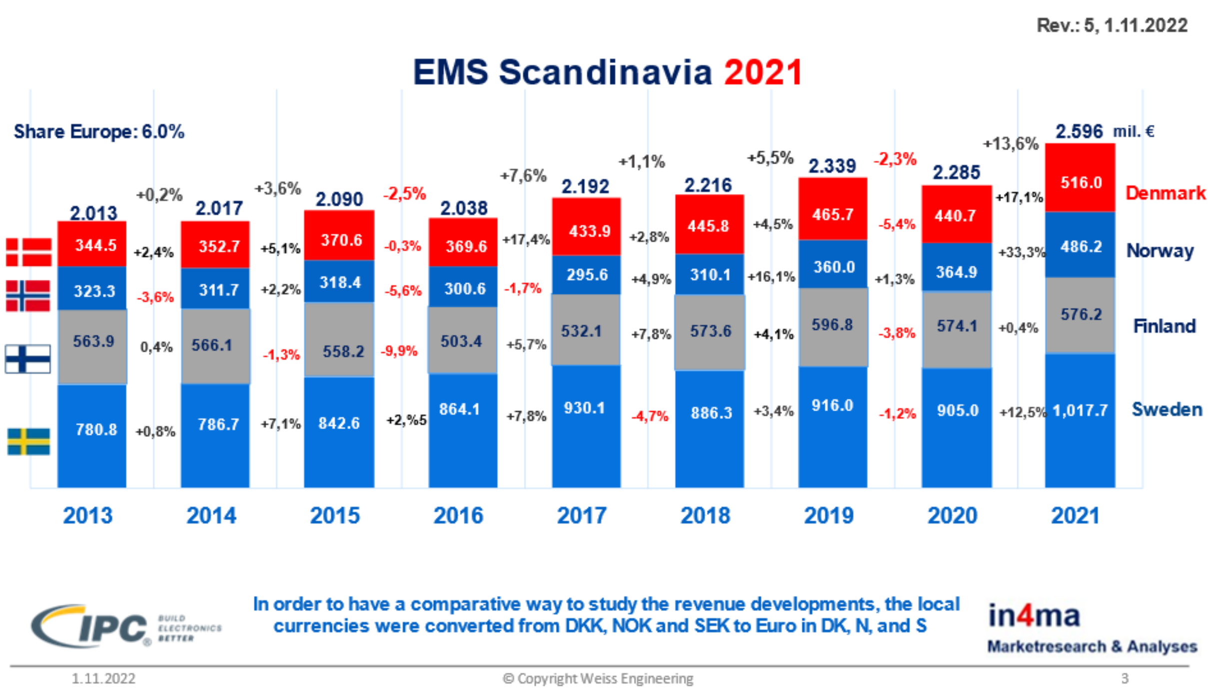
SWEDEN:

We toured five EMS companies in Sweden: Enics (now part of the GPV Group), Inission, Kitron, Orbit One, and Scanfil.



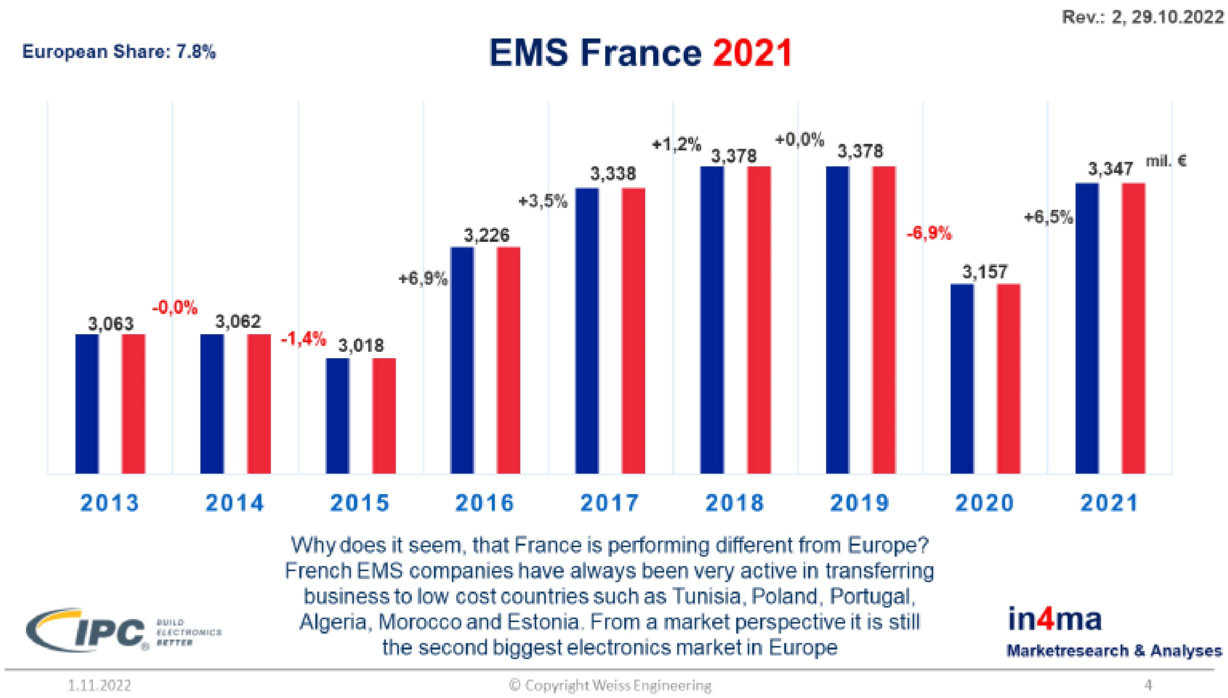


In4ma also shared an overview of the Scandinavian EMS market. This reflected the historic development of the EMS industry in the four countries that compose Scandinavia: Denmark, Finland, Norway, and Sweden.

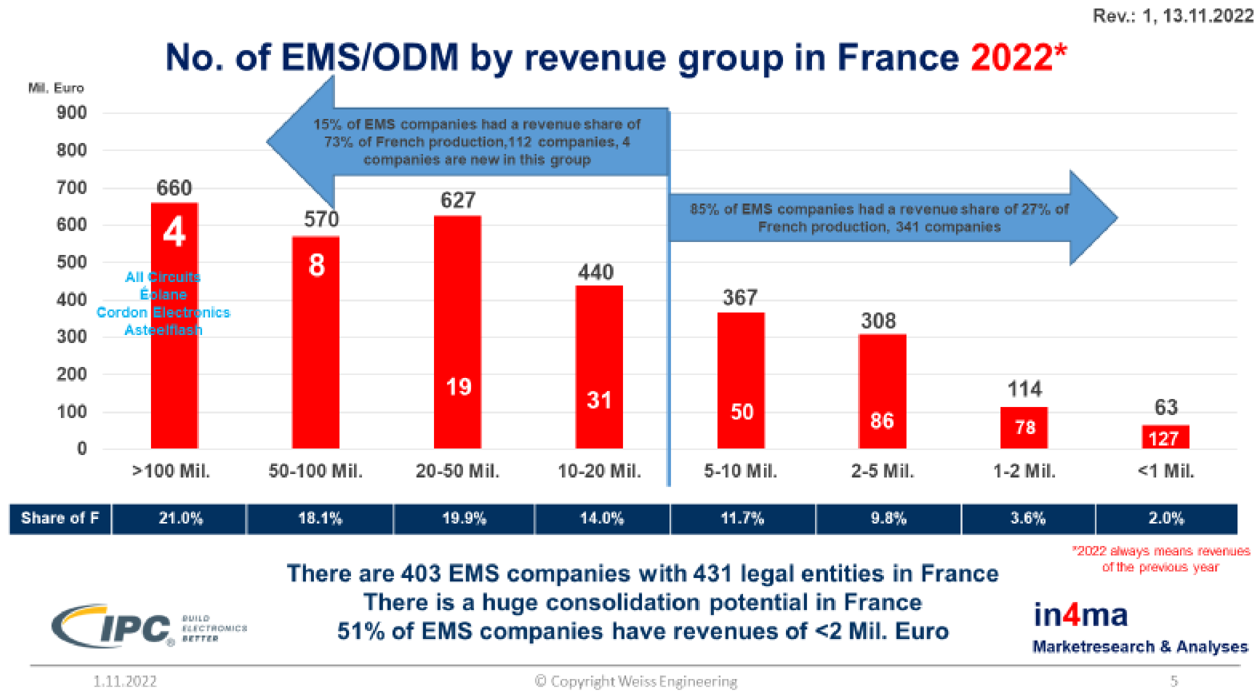


FRANCE:

We toured three EMS companies in France: All Circuits, Asteelflash, and Lacroix.

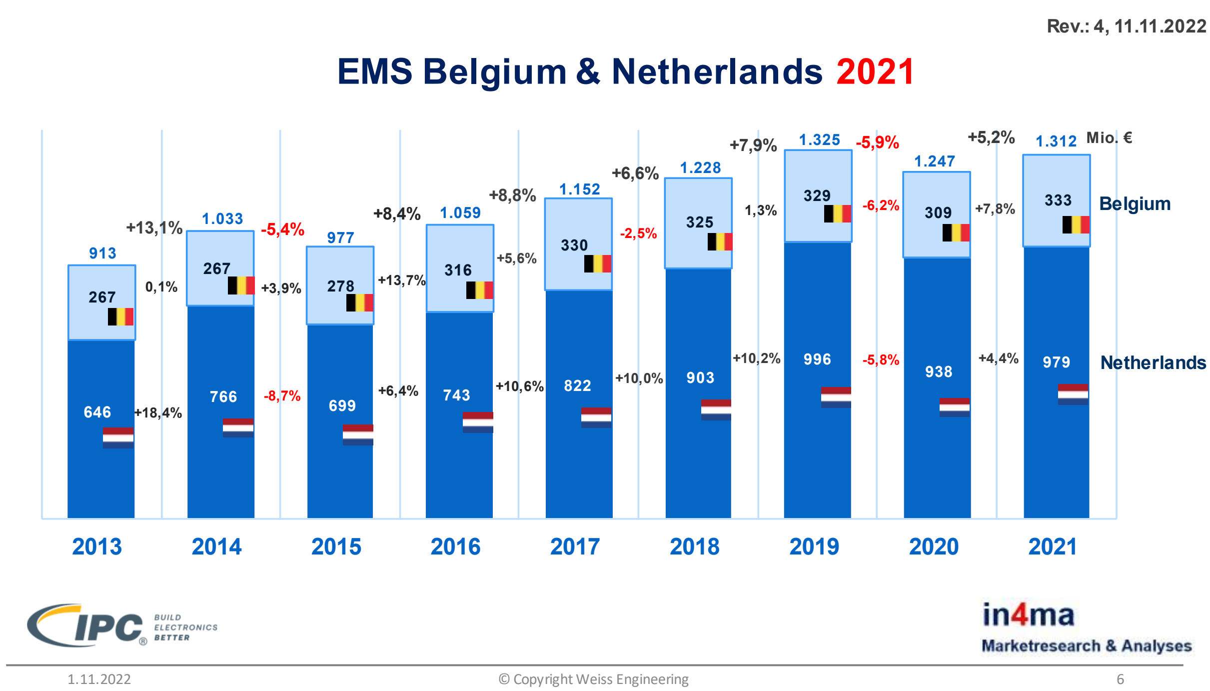


France has the second highest number of EMS companies of any country in Europe after Germany. The vast majority of these companies are small as reflected in this slide.



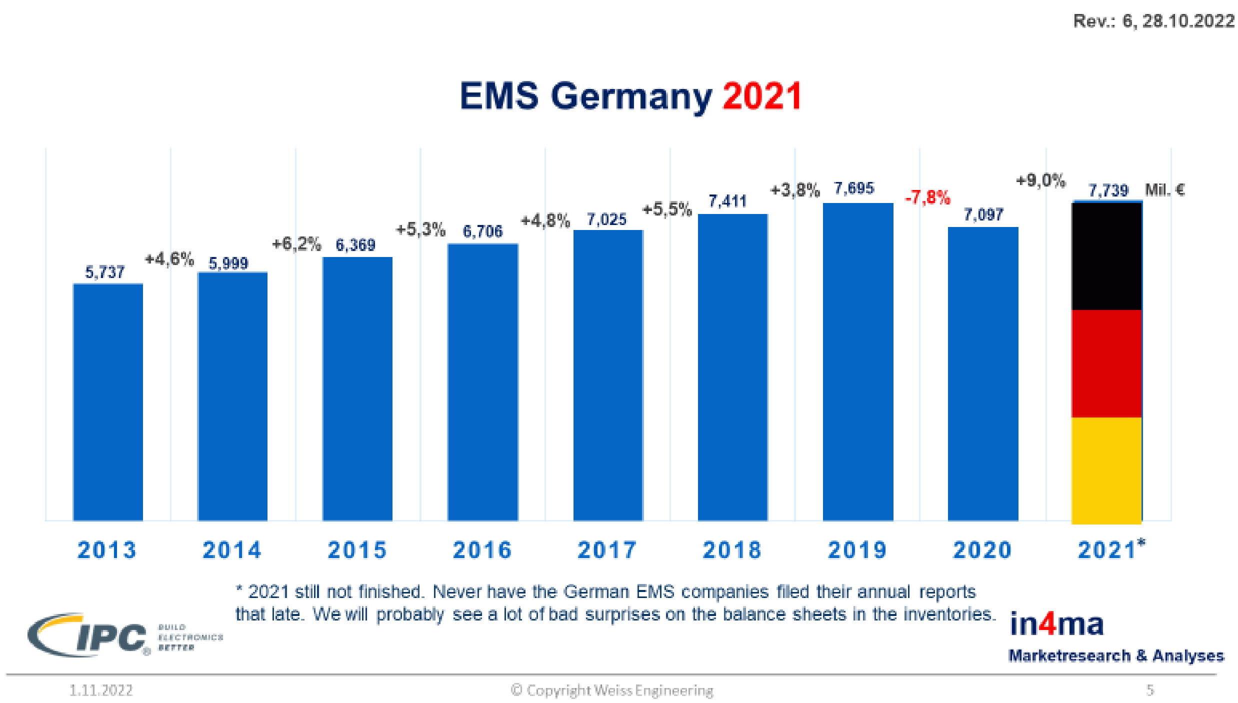
BELGIUM & THE NETHERLANDS:

We toured one EMS company in Belgium: C-MAC; and two EMS companies in The Netherlands: Prodrive Technologies and VDL TBP Electronics.



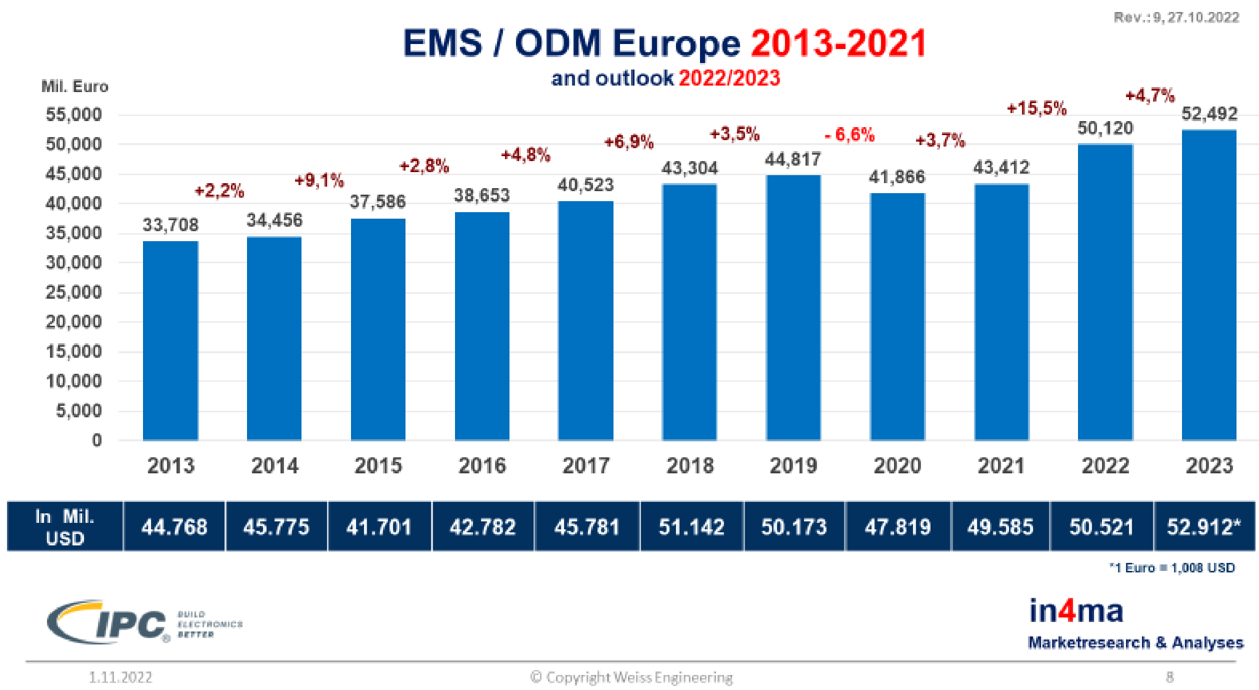
GERMANY:

We toured four EMS companies in Germany: Bavaria Digital Technik (BDT), Coronex EMS, Fritsch Elektronik, and Katek.



EUROPEAN EMS INDUSTRY:

In4ma also shared historic data on the overall European EMS industry, including its forecast for 2022 and 2023, and the current ranking of the largest European EMS companies.



Rev.:9, 27.10.2022
EMS / ODM Europe 2013-2021
and outlook 2022/2023
Mil. Euro
55,000
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
33,708
+2,2%
34,456
+9,1%
37,586
+2,8%
38,653
+4,8%
40,523
+6,9%
43,304
+3,5%
44,817
- 6,6%
41,866
+3,7%
43,412
+15,5%
50,120
+4,7%
52,492
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
In Mil. USD
44.768
45.775
41.701
42.782
45.781
51.142
50.173
47.819
49.585
50.521
52.912*
*1 Euro = 1,008 USD
IPC BUILD ELECTRONICS BETTER
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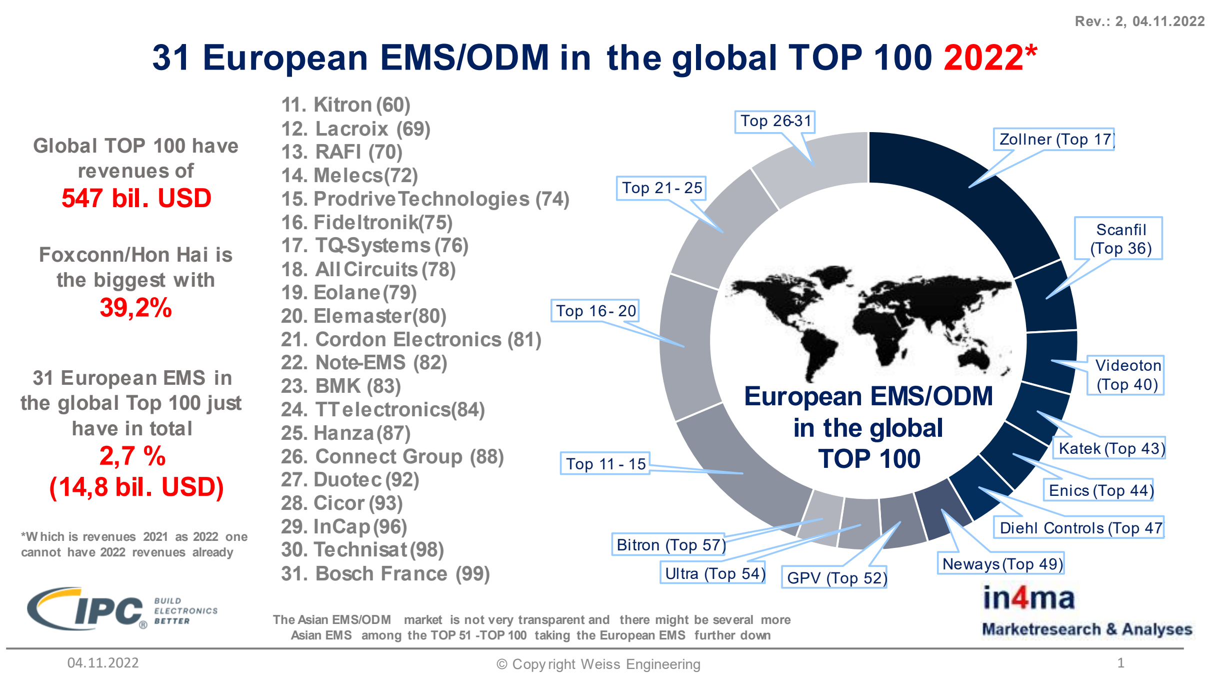

Rev.: 2, 04.11.2022
31 European EMS/ODM in the global TOP 100 2022*
Global TOP 100 have revenues of
547 bil. USD
Foxconn/Hon Hai is the biggest with
39,2%
31 European EMS in the global Top 100 just have in total
2,7 %
(14,8 bil. USD)
*Which is revenues 2021 as 2022 one cannot have 2022 revenues already
11. Kitron (60)
12. Lacroix (69)
13. RAFI (70)
14. Melecs(72)
15. Prodrive Technologies (74)
16. Fideltronik(75)
17. TQ-Systems (76)
18. All Circuits (78)
19. Eolane (79)
20. Elemaster (80)
21. Cordon Electronics (81)
22. Note-EMS (82)
23. BMK (83)
24. TTelectronics(84)
25. Hanza (87)
26. Connect Group (88)
27. Duotec (92)
28. Cicor (93)
29. InCap (96)
30. Technisat (98)
31. Bosch France (99)
Top 26-31
Top 21 - 25
Top 16 - 20
Top 11 - 15
Zollner (Top 17)
Scanfil (Top 36)
Videoton (Top 40)
Katek (Top 43)
Enics (Top 44)
Diehl Controls (Top 47)
Neways (Top 49)
GPV (Top 52)
Ultra (Top 54)
Bitron (Top 57)
European EMS/ODM in the global TOP 100
IPC BUILD ELECTRONICS BETTER
The Asian EMS/ODM market is not very transparent and there might be several more Asian EMS among the TOP 51 -TOP 100 taking the European EMS further down
in4ma
Marketresearch & Analyses
04.11.2022
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OBSERVATIONS & TRENDS

In addition to touring the facilities, we also spent time with executives from each company to discuss their business and the issues impacting the EMS industry. Based on these conversations, we compiled this list of issues and trends impacting the EMS industry. This list does not include all of our observations, but only the main themes we thought noteworthy.

Europe continues to be a vibrant and evolving region for the global EMS industry. It is impacted by the same challenges that the industry at large faces in all regions, although the war in the Ukraine does pose a unique situation and ongoing challenge.

It is hard to speak of any one of these trends in isolation as they are all interrelated, so please consider the full tapestry of these trends rather than one in isolation when assessing the EMS industry in Europe.

- **EMS Industry Size & Growth:**
  - The European EMS Industry is comprised of both domestic and foreign EMS companies.
    - The largest EMS operating in Europe is Foxconn, as it is seemingly in every region.
    - The largest indigenous EMS in Europe remains Zollner Elektronik AG.
  - In 2021, Europe accounted for roughly 9% of the global EMS industry.
  - The European market can be segmented further as follows:
    - Germany – 17.9%
    - France – 7.8%
    - Scandinavia – 6%
    - Sweden – 2.4%
    - The Netherlands – 2.3%
    - Belgium – .8%
  - In4ma has forecasted growth for the European region in 2022 which was supported by every EMS company we met.
  - Most EMS we met reported a strong book of back orders. There is some discussion of how much “hot air” might exist in those backlogs, but the general theme was for positive continued growth.
  - All EMS we met see a lot of available business in 2023.
  - According to in4ma, western Europe is expected to grow at a higher rate than Eastern Europe in 2022. This reverses a historic trend for more rapid growth in Eastern Europe.
  - The EMS industry as a whole is still relatively unfamiliar to many European OEMs. EMS need to do a better job as an industry elevating their profile and value proposition to OEMs.

- EMS companies are raising prices for the first time in over a decade due to the increasing costs they have to sustain due to energy, inflation and increasing labor costs.
  - More on this later in this report.
- Product quantities manufactured have increased in 2022.
- There are some very good "operators" in the European EMS industry.
  - The term "operator" is a colloquialism that refers to executive managers who are experienced and competent in the business of EMS.
- The main growth drivers for the EMS industry in Europe, as reflected by most of the companies we met, are:
  - Increased electrification of the world in which we live and operate.
    - This is especially true in the industrial sector with IIoT.
    - Also, the increase in sensors that are proliferating in our world.
  - Reshoring:
    - Most EMS we met shared examples of reshoring from Asia/China back to Europe.
  - More outsourcing by OEMs expected:
    - The general sentiment of all EMS we met was that European OEMs will be outsourcing more.
    - More on this in the next section.
  - Adoption of more EMS services by OEMs:
    - EMS are selling more of their services to OEMs (e.g., box build, full system integration, fulfillment, aftermarket services).
    - Once OEMs successfully outsource PCBA, they tend to be receptive to utilizing more of the services EMS has to offer.
  - Sector megatrends:
    - IIoT and e-mobility are the main trends expected to propel the industry.
    - Defense electronics is expected to remain strong due to geopolitical strife and the need to replenish what is being expended.

➢ **OEM Outsourcing Potential**

- The EMS industry in Europe has matured and OEMs are increasing the amount they outsource.
- This is evidenced by the growth of more complete range of services (i.e., design, system integration, and aftermarket services) by OEMs.
- This reflects more trust by OEMs in EMS companies / model.
- The more OEMs outsource, the more that EMS companies become their true manufacturing partners and the less manufacturing knowledge that is retained by OEMs.

        - This is a trend that has occurred throughout the EMS industry in other regions, notably North America.
    - The percentage of electronics manufacturing that OEMs have outsourced in Europe is estimated by in4ma to be about 41%.
        - This was higher in Sweden than in the other countries we visited.
    - This means that there is about 60% of electronics manufacturing still being done internally by European OEMs and indicates the potential for EMS growth.
    - There are many mid-sized family-owned companies, especially in Germany (i.e., Mittelstand) and France. These companies feel they have a social responsibility to sustain their business and employment.
    - Other issues that impact OEMs' decision to retain in-house manufacturing include:
        - OEMs outsourcing old versus keeping newer technologies,
        - OEMs only outsourcing PCBA versus other services.
        - IP sensitive items
    - Younger OEMs that do not have a legacy of internal manufacturing are more likely to embrace outsourcing more fully.
    - Some OEMs are also providing EMS services to other OEMs, notably Bosch.
    - EMS are increasingly seen as the electronic manufacturing experts.
- **Amazing Amount of Automation**
    - The degree of factory automation we witnessed was impressive.
    - The automation of SMT lines has existed for decades now, but there is an investment in upgrading to newer more proficient machines.
    - This includes laser marking, jet printers, SPI, and AOI (pre- and post-reflow).
    - Selective solder is becoming more popular.
    - We saw in-line x-ray, test fixtures, and even a flying probe.
    - Many EMS used only one technician to run/monitor a line.
    - Warehouses also have highly automated systems with cobots / autonomous warehouse robots.
    - The focus is now on automating more post-reflow functions when possible.
        - Many companies have their own industry groups that help set up automated cells to handle post-reflow repetitive tasks.
        - Widespread use of robots.
        - We saw one high volume line that was comprised of 32 work cells with robots.
    - There was a degree of own country preference for SMT equipment on display: Sweden = Mycronic; Germany = ASM; France = Europlacer.
    - We saw one facility that had no paper on the shop floor at all.
    - The drive to automate is critical to these companies' ability to be competitive globally, but it does require investment.

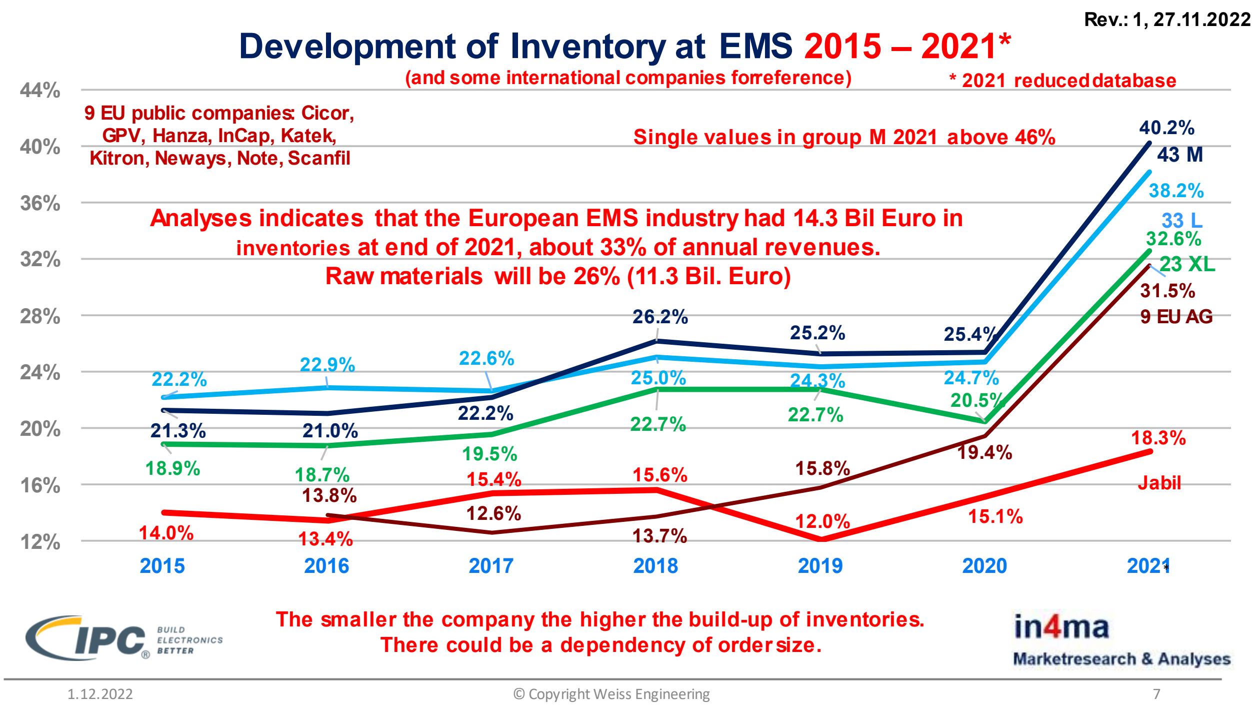
- The “factory of the future” envisioned by Industry 4.0 seems to be getting closer to reality. One EMS we met has a goal to operate its factories 24/7 at 80% utilization rate.

- **More Services Offered…**
  - PCBA is the core service traditionally offered by EMS and is now the commoditized part of the industry.
  - EMS have pursued vertical integration for years, and those services are increasingly being used by OEMs.
  - Design services are standard, although some smaller mid-sized EMS use partners for this.
  - Use of box build / final integration and after-market services is growing.
  - Chip on board technology and power electronics are also picking up.
- **Industry Sectors are Morphing…**
  - The work being done by EMS does not categorize easily into the traditional industry sectors of automotive, communications, computer, consumer, industrial, medical, and mil/aero.
    - Companies have created some unique categories which makes it harder to compare and size certain industry sectors.
  - Electrification and more electronics in all aspects of our lives is driving development of diverse sectors.
  - This is especially true in the area of Industrial Internet of Things (IIoT).
  - Automotive electronics within EMS is a challenging business, and generally considered less profitable.
    - E-mobility is an interesting and growing business sector within Automotive.
      - This includes vehicles, charging stations, and home chargers.
    - Interestingly, there is very little automotive manufacturing being done in Scandinavia and is more common in France and Germany.
  - Low Volume/High Mix to Medium Mix is the most common type of production being done in Western Europe.
    - We heard of lot sizes in range of 200- 300 per month, with one build as low as 6 per month. This reflects the industrial work being supported.
    - One company had a test fixture dating from 1968 that was last used two years ago.
  - High Volume is automated and/or being done in Eastern Europe.
- **Materials please…**
  - Material challenges persist, but improvement is noted.
  - All EMS reported holding higher inventory levels waiting for a “golden screw” so they can complete their builds.
  - in4ma’s analysis is that EMS inventory levels have already doubled those of 2021 and will increase at least another 25% by the end of 2022. The calculations show

that there will be 14 billion Euros in raw materials (w/o WIP and finished goods) on the shelves of the European EMS companies. This is an all-time high and probably similar at the OEMs.

  - The image invoked by several EMS related to their material warehouses is that of Donald Duck's rich Uncle Scrooge (known as Dagobert Duck in Europe) diving into piles of money.

- The most cited missing parts were active components from TI, Intel, and ST Micro.
- All EMS reported increased spot buys last year, which indicates that the material was available in the market. This is a drag on cash and impacted financial performance / profitability.
- NCNR (non-cancellable, non-returnable) terms from material suppliers are more common. It will be interesting to see if EMS start pushing out their orders from distributors in order to burn up their own existing inventory before taking on more
  - As one EMS executive said when I asked about NCNR…"We will see!"



- Many see material supply chain challenges improving in 2023.
- The performance of the Authorized Distribution model is not being judged well.
  - The value proposition for Distributors has been that they hold inventory and provide parts when needed. They are less willing / able to do so now.
  - Distribution was judged by most people we spoke to as underperforming.
    - Lack of timely communications was the most common complaint.

        - This is a sensitive topic for EMS who will need distributors when the material supply chain returns to whatever the new normal will be.
  - The supply chain crisis has opened opportunities and relationships with brokers in the spot market.
    - This may remain so after the crisis settles as these partners have proved themselves and earned trust.
  - EMS are also bypassing distributors and increasing purchases directly from material suppliers.
    - Smaller EMS are less in a position to do so.
  - Discontinued parts are a problem still to be realized. There are few alternatives.
  - EMS are proving their resiliency and creativity:
    - We heard stories of EMS that were having to reuse components and re-ball BGAs.
    - One EMS had a customer for whom a particular component was unavailable, but they were able to find the part on a test board that was available for purchase. So, the EMS was buying the small test boards and removing the component to use on the customer's board.
    - These are not ideal situations, but they are getting customer products built.
- **Business Costs are Rising**
  - **Material** costs are up
    - The increased use of "spot buys" over last few years is what accounts for higher material costs.
    - Solder paste cost also reported as higher due to increased pricing of base materials like tin.
  - **Energy** costs are increasing but are impacting companies differently based on a country's energy supply sources.
    - Nuclear, hydro, and wind are the most common sources in Sweden.
    - Nuclear is the most common in France.
    - Germany uses more biocarbon like oil and gas.
    - Germany has examples of gas cost rising 400%.
    - Electricity costs in the Netherlands was reported up 400%.
    - Sweden is supposed to be giving a rebate from the government for high energy costs to all residents and businesses.
    - Most EMS are passing these costs through to the customer.
  - **Inflation** is driving up workers' wages.
    - Labor costs up, from 2021 to 2022
      - France = 9%
      - Belgium = 8.14%; 2023 fixed at 9.2% due to inflation
        - In Belgium it is mandatory that it gets tied to inflation
      - Germany = 3% in 2022 and 5.5% expected in 2023.

            - Union negotiations are part of this process, and we heard a rate of 7-8%
        - These inflation rates are higher than what EMS companies can afford to pay in labor increases
    - This results in desire for increased automation
  - **Workforce** challenges persist.
    - Available labor will remain the biggest ongoing challenge for the industry.
    - Many countries have low unemployment rates, plus it is challenging to get younger workers to do repetitive manual tasks.
    - Automation makes work more interesting for younger people.
    - One EMS we saw (Prodrive Technologies) was noteworthy due to the youth of its workforce.
      - This was probably due to it being a very 'cool' automated workplace that allows these workers to learn interesting skills, and not just PCBA.
  - **Environmental** issues / impact.
    - Factories are becoming more efficient with many having solar panels on their roofs and smart factory sensors to save energy in places not being used.
    - Electrification also results in OEMs making products that support being more environmentally clean and sensitive.
  - The focus for all companies we visited was on improved efficiencies.
    - Lean principles were employed.
    - Energy consumption awareness was evident.

- **Financial Constraints**
  - Due to the issues just discussed, and mostly attributable to the higher-than-normal inventory levels being held by EMS, many companies have to be selective in what and how they chose to invest.
  - This is a burden felt especially by smaller EMS.
  - The hope is that inventory levels will be reduced in the coming year as the availability of key components improve.
- **Digitalization of the Factory Floor**
  - Generally, everyone has connected their machines so they can exchange data.
  - They are using standardized protocols / languages (e.g., IPC-CFX-2591, IPC-Hermes-9852)
  - The focus is on analytics and making improvements based on data gathered.
  - They are training people up, so they know how to do this, and it becomes part of the process.
  - The high inventory levels currently being held by EMS are impacting their ability to make certain investments, and digitalization is one of many areas impacted.

- **The Urge to Merge:**
  - There is seemingly a lot of interest in M & A on both the buy and sell side in Europe.
  - Many smaller EMS firms are seeking to get bigger or join a larger company.
  - Most of the EMS in Europe have annual revenues below 15 million Euros (which represents 1874 legal entities), according to in4ma.
    - There will probably be more business failures as inventory challenges get worked out.
  - Larger European EMS have also started to acquire EMS facilities in North America. For example: Zollner, Katek, Lacroix, SERO.
    - We expect this trend to continue.
- **Low-Cost Regions (LCR)**
  - Eastern Europe is still popular, although according to in4ma, Western Europe will grow faster in 2022.
    - This is mostly due to the fact that Eastern Europe does more work in the 3Cs (communication, consumer, and computer) sectors.
  - Tunisia is an emerging LCR that has around 20 EMS companies and several OEMs, high unemployment of about 17%, a well-educated population, and labor cost that is about 20% of France.
- **Local for Local = Regionalization**
  - This trend, on which the EMS industry was originally founded, is driving the reshoring to Europe from China.
  - This also means that China will remain relevant and EMS we spoke to with facilities there are doing local for local from those factories.
  - China will also remain the primary supplier of PCB boards and most electronic materials needed to complete electronic products.
- **in4ma** is the most respected EMS market research firm in Europe.
  - The EMS we met with all seemed to validate the in4ma numbers, analysis, and forecasts.
  - I have now witnessed firsthand how meticulously in4ma researches, validates, and then updates their data sets. Many times, during our meetings in4ma would adjust the company's database numbers based on what we were being told and then show the updated industry rankings to the EMS within minutes.
  - I don't intend this to be blatant marketing pitch for our partner, but they do produce the best market research in the EMS industry available today.

CONCLUSION:

- The EMS industry in Europe is vibrant, dynamic, full of great modern capability, good EMS operators, and poised for growth.
- It has its challenges but seems to be managing through these with creativity and determination.
- Increased outsourcing by OEMs of more services and also reshoring of manufacturing from Asia/China will fuel the growth of the industry.
- More industry consolidation is inevitable and necessary.
- I think the difference on who succeeds in the business will come down to the management teams running these companies. So, I would pick the jockey over the horse, assuming it is a horse and not a mule or donkey they are riding.

Stay tuned for updates on next year's tour and which region(s) we will be investigating next.

Thank You!