

Supply Chain Innovation



Challenges and Solutions in global supply chains with semiconductors
EIT Manufacturing South event @WMF November 25 2022
Hans Ehm





- Hans Ehm M.S./OSU
- Senior Principal Engineer Supply Chain
- Head of Supply Chain Innovations
 - Knowledge & Academy & Audits
 - Partnership & Simulation & Trends
 - AI & DL & Quantum Alg. & Solutions
 - Digital SC for Decision support & Funding
 - Semantics & Knowledge Graph & Complexity Management



- Additional commitments:
 - Lead the working group SCM of ZVEI
 - Work package leader of H2020/ECSEL projects like productive40 & Initiator of EU SC³ project - Semantically connected semiconductor supply chains
 - Lead PG 6.8 of the VDA QMA and consulted semiconductor supply chain Expert of the “Ad hoc Expertenkreis Resilienz des BMWK”

Infineon at a glance

Long-term high-growth trends

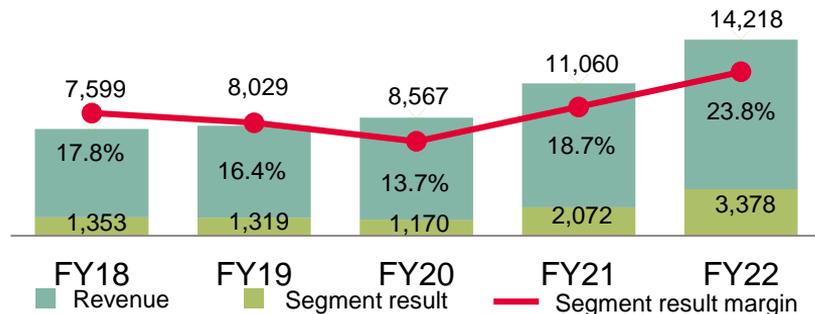
Decarbonization

- › CO₂ saving
- › Energy efficiency
- › Sustainability

Digitalization

- › Productivity
- › Comfort
- › New use cases

Financials



¹ as of 30 September 2022 ² 2022 Fiscal year (as of 30 September 2022)

Employees¹

56,200 employees worldwide

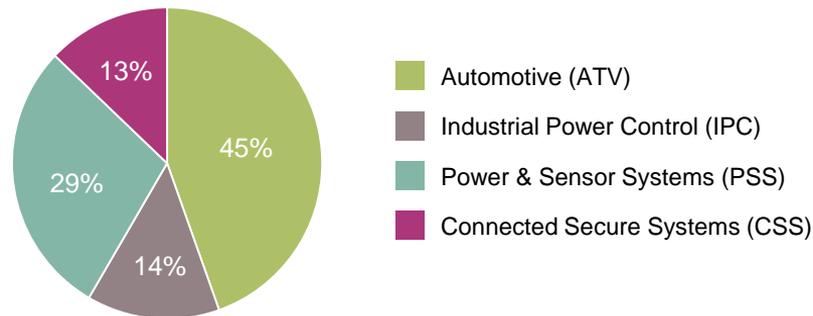
Americas
5,580

EMEA
22,590

Asia Pacific
28,030

56 R&D and
20 manufacturing locations¹

Business segments revenue²



For further information: [Infineon Investor Presentation Q4 2022](#).

Agenda

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Challenges in Complex Semiconductor Supply Chain

2

The global Flexibility answer to these Challenges

3

The current global chipshortage

4

A sustainable way out supported by Associations & funded projects

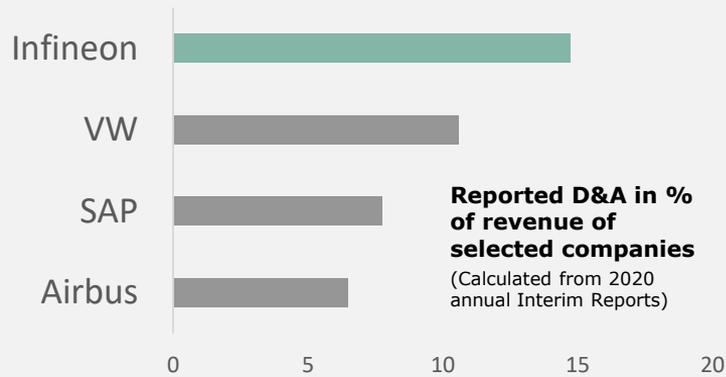
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Executive summary

The semiconductor industry is characterized by capital intensity & high demand volatility; Capital Risk & Demand Risk

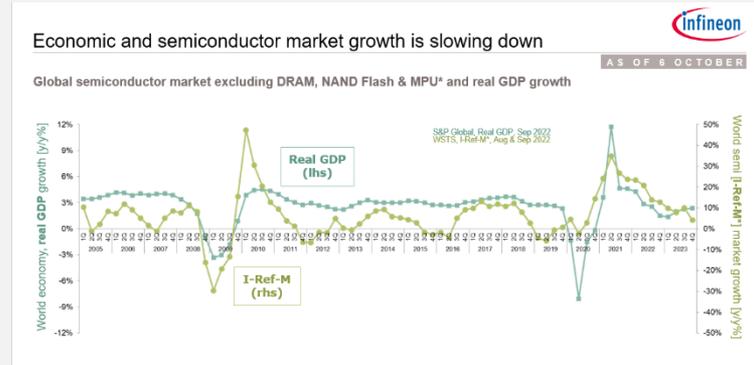
Characteristics of the semiconductor industry

Semiconductor manufacturing is highly capital intense



- 24*7 operations due to capital cost and technical reasons
- Capacity lead times up to one year due to special machines
- A new fab costs more than 1 billion Euro

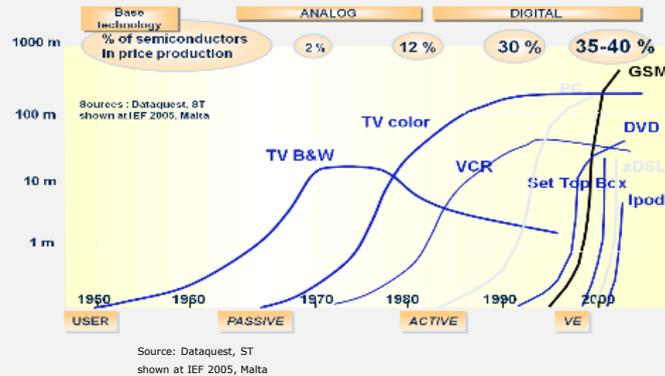
Semiconductor demand is difficult to forecast – also before COVID



- Dynamic markets
- Rapid innovation cycles
- Bullwhip effect

Semiconductors are challenged by steep ramp & short lifecycle of its products and an internal intrinsic long cycle time – Obsolescence Risk

Short product life but intrinsic long own Cycle Time



- Steep product ramp-ups/-downs
- Short product lifecycles



- Intrinsic long internal cycle times
- Positioned early in the value chain

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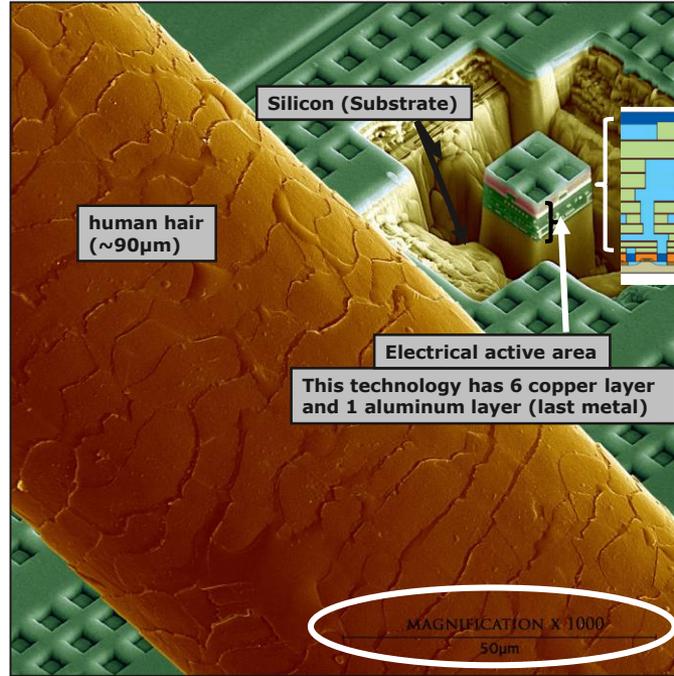
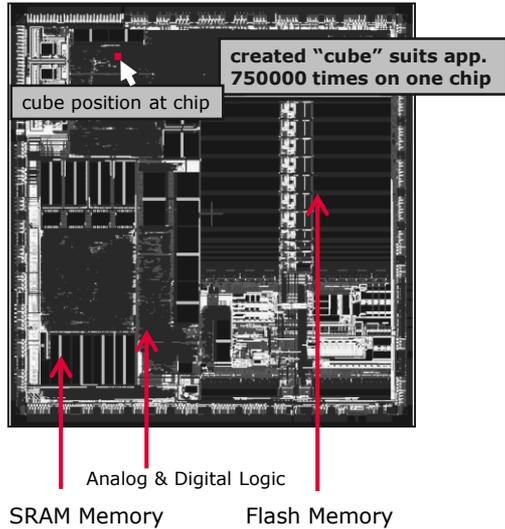
Executive summary

Supply Chain orchestrates the Network of Frontend, Backend, Distribution Centers, Silicon Foundries and Subcons like one Global Virtual Factory – but why?

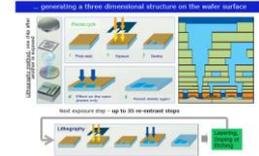


A solution in SC³ - **S**emantically **C**oordinated **S**emi**C**onductor **S**upply **C**hain

Semiconductors are tiny, complex manufactured in a global network



The process - Process control



The Fab - Yield & supply



The global supply chain - demand



DataSpace: From ns and nm to years and thousands of km
 10^{-9} to 10^9 s * 10^{-9} to 10^7 m ~ 10^{34} * Other dimensions

Does this really need to be so complicated?

We have found no better way & experts see us leading



European SCE Award: Education



ROI: Best of the Best Industrial 4.0 Award for smart supply chain



Selected successful best practice companies



European IEA Award from WHU

Industrial Excellence Award Germany 2017

And the Winner is: Infineon!

2017

Jetzt ist es offiziell: Infineon gewinnt den diesjährigen „Industrial Excellence Award Germany 2017“ in der Kategorie „Enterprises“ – vergeben durch die WHU (Otto Beisheim School of Management). Die Preisverleihung findet am 4. Oktober im Rahmen der „Industrial Excellence Conference & Award“ in Berlin statt.



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This overshooting in the supply chain known as Bullwhip is not new producing faster in a 365/7 eco-system at 1000 process steps+ is barely possible → other solutions needed



SC a competitive advantage

Ideen zur Synchronisation der gesamten Supply chain:
vom Silizium Wafer zum Automobil

ITA Kongress, Wolfsburg
13. / 14. September 2010



Innovative semiconductor solutions
for energy efficiency, mobility
and security

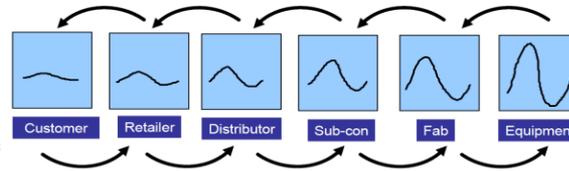
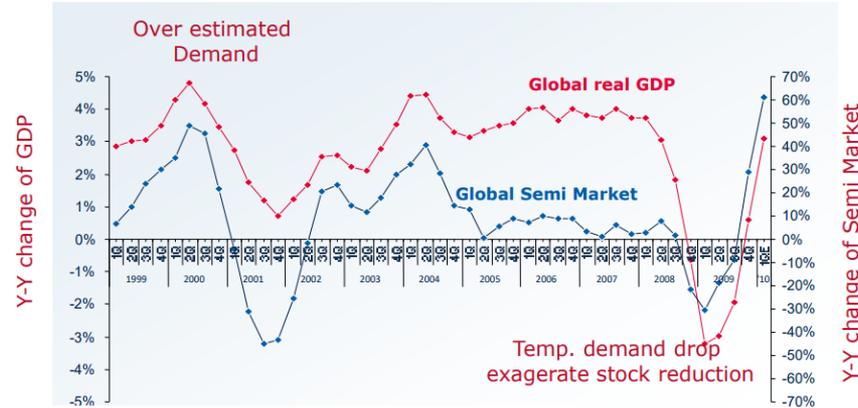


Automotive Prozesse & IT 2012
12./13. September 2012 im Saarbrücker Schloss

Innovation in globalen End-to-End Supply Chains -
Herausforderungen für agile Prozessketten



Sharp down turn are followed by steep up turn –
Aligned supply chains can reduce the bullwhip



**Bullwhip Effect
Overshooting in
the value chain**

*US
Sou
rntf

d. January & February sales figures for the

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4-steps approach to overcome chip & material shortage and use EU chip act to manage a dynamic environment for supply chain leadership



Higher Inventory

- › Activities to achieve an optimized inventory
- › Activities are ongoing



Anonymous Survey

- › Get a picture of the true demand
- › Anonymity important: Utilize MPC to overcome tactic demand



AI-based Forecast

- › Anonymity with MPC (Multi Party Computing)
- › Utilize Semantic Web to handle complexity and ensure interlinking and understanding
- › Acceptance of AI results by humans



Lead Time based Pricing

- › Monetary enforced reduction of bullwhip (RM)



Supplier Enablement

- › Provide a path for investment in Europe e.g. with EU funding



Consecutive steps to mitigate the bullwhip effect and related shortages



4 step approach in multiple EU / BMWK (German) funded projects, events & associations

- [EU Productive40](#) (Infineon, NXP, ST, Bosch 100 companies, 3y, 100'€ Budget → beyond others semantic web (Digital reference); *closed*; **BMWK**: [GAIAX4PLC](#) (Infineon, BMW, ...) and [CoyPU](#) running)
- [EU SC³](#) (Infineon, Bosch, Ecole de Mines (supports ST), TIB); *running provides the semantic web*
- [AKJ](#) (Arbeitskreis Just in Time; German OEMs & TierX); *continuous & on the Agenda today*
- [VDA](#) QM working group 6.8 (German OEMs, key Tier 1); *running – separate group on: „mitigating bullwhip and sustainable avoid chip shortage using the 4 step approach as initial guidance“ in discussion - running*
- [ZVEI woking group SCM](#) – readout at Electronica Nov 14th; [ZVEI FG Halbleiter](#) is regularly informed
- Wintersimulation / [MASM 2022](#) in December 22 in Singapore (Marina Sands Bay); *continuous*
- [Dagstuhl](#) Events on [supply chains containing semiconductors](#) ([Prof. Chen Fu –Chien](#) (close to TSMC), Intel (Israel), other semiconductor researchers); *continuous Next one: [Sept. 3-8 2023](#)*
- End June Samsung got interested and ready to collaborate (with KAIST and TUM for incubation)
- Follow up on MIT Hackathon on Chip shortage from March with SAP
- July 11 – US BIS ([US Chips act](#)) & EU KDT ([EU Chips act](#)) Meeting on True Demand (6 US/6 EU invites)
- Ad hoc Expertenkreis Resilienz des BMWK – follow up in Nov. and Dec. after Sept. Meeting

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Executive summary: Supply chains containing semiconductors could benefit from our semiconductor Supply Chain Journey



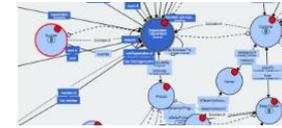
2007: [Lean for complex flow manufacturing](#)



2011: Best of breed IT Tools with superior Master Data enabled Flexibility to growth faster than peers in upturn (Plan focus)



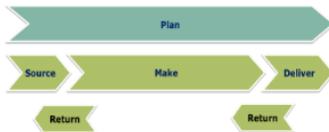
2015: Discrete & Agent based simulation enable further optimization in Plan, Make and Deliver



2019: Digitalization boost with semantic technologies, AI and Deep Learning; HAI Game as enabler

Our path towards Supply Chain as sustainable competitive advantage

< 2007: Using SCOR as a standard (Deliver focus)



2009: Supply Chain is our global Fab (Make focus)



2013: Fine-tuning Supply Planning and S&OP via advanced capacity / demand match (Automation)



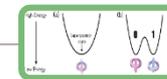
2017: Supply Chain one key enabler for a successful merger



2021: Harvest MPC & Semantic web for the industry & AI on Platforms, True E2E for sustainable SC³



explore QA & UQC & Cypress Merger



Corporate Social Responsibility (Infineon example)

Less Bullwhip, Better supply chain, more chips, less CO₂



Our products and solutions enable a net ecological benefit, equal to the average annual CO₂ emissions from electricity consumption of more than 119 million people living in Europe.¹



Net ecological benefit: CO₂ emissions reduction of more than 70 million tons



¹ Based on the average electricity consumption of private households in Germany and official energy conversion factors.

² This figure takes into account manufacturing, transportation, own vehicles, travel, raw materials and consumables, chemicals, water/waste water, direct emissions, energy consumption, waste, etc. as well as direct and indirect energy-related emissions by manufacturing service providers. It is based on data collected internally and publicly available conversion factors and relates to the 2021 fiscal year.

³ This figure is based on internally established criteria, which are described in the explanatory notes. The figure relates to the 2020 calendar year and takes into account the following application areas: automotive, LED, induction cookers, servers, renewable energy (wind, photovoltaic) and cell phone chargers as well as drives. CO₂ savings are calculated based on the potential savings generated by technologies in which semiconductors are used. The CO₂ savings are allocated based on Infineon's market share, semiconductor share, and the lifetime of the technologies concerned, based on internal and external experts' estimations. Despite the fact that carbon footprint calculations are subject to imprecision due to the complex issues involved, the results are nevertheless clear.

Interested?
Get in contact with me if you like



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