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RISK MANAGEMENT IN SUPPLY CHAINS.

Hidden risks as shown by automotive electronics.

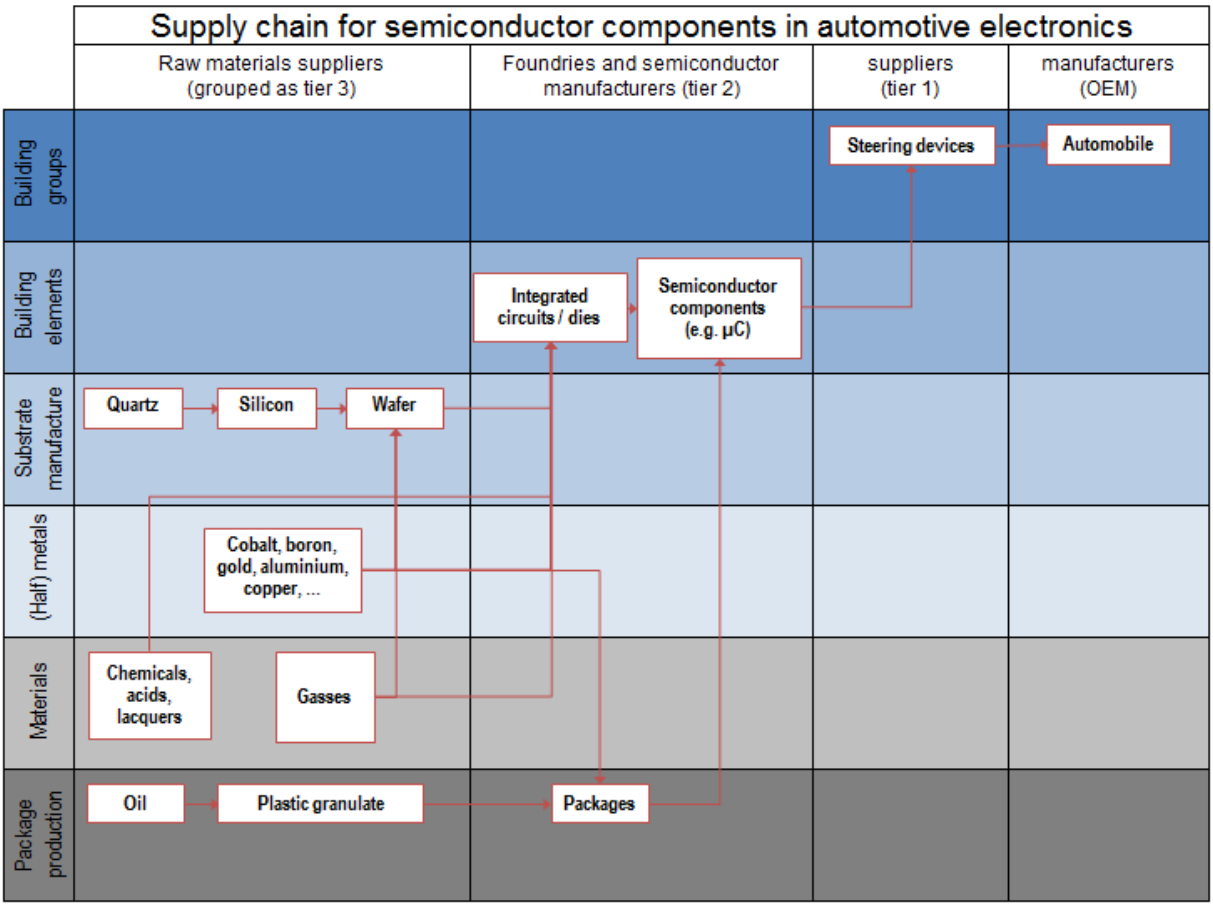
The “world cars” of today are manufactured in multiple factories across several continents, and this increasingly international, globalised form of production is having an ever stronger effect on supply chains in the automotive industry, leading to an extremely strong growth in the levels both of complexity and efficiency in the process. The logistics of supplying these worldwide works is a challenge for any manufacturer, and although existing concepts such as just-in-time and just-in-sequence facilitate a high supply chain efficiency, they also greatly increase the vulnerability of global supply chains.

For this reason, risk management in the supply chain has long been part of the standard toolkit of original equipment manufacturers (OEMs), who examine suppliers (tier 1) not only on their technical but also on their financial performance. In many cases, OEMs apply principles of dual or multi-sourcing to get the same parts from two or more suppliers and ensure supply even if one of the manufacturers contracted is no longer able to keep up deliveries.

On closer analysis, the holes in even this strategy become clear when the suppliers' suppliers (tier 2) is examined, and in this article, we will be looking at an example of this issue with explosive potential: the concentration of semi-conductor manufacturing for Automotive at a small number of manufacturers – in some cases, at only one.

1| INITIAL SITUATION

Modern cars offer a number of electronic functions for a range of areas such as motor control, safety, comfort, infotainment, and lighting, all of which are handled using control devices. These controllers are developed and produced by electronics suppliers, who in turn buy in electronic components from second-tier suppliers, who in turn purchase pre-materials from tier-three suppliers; this creates supply chains which become more and more complex along the value-creation chain (see Figure 1).

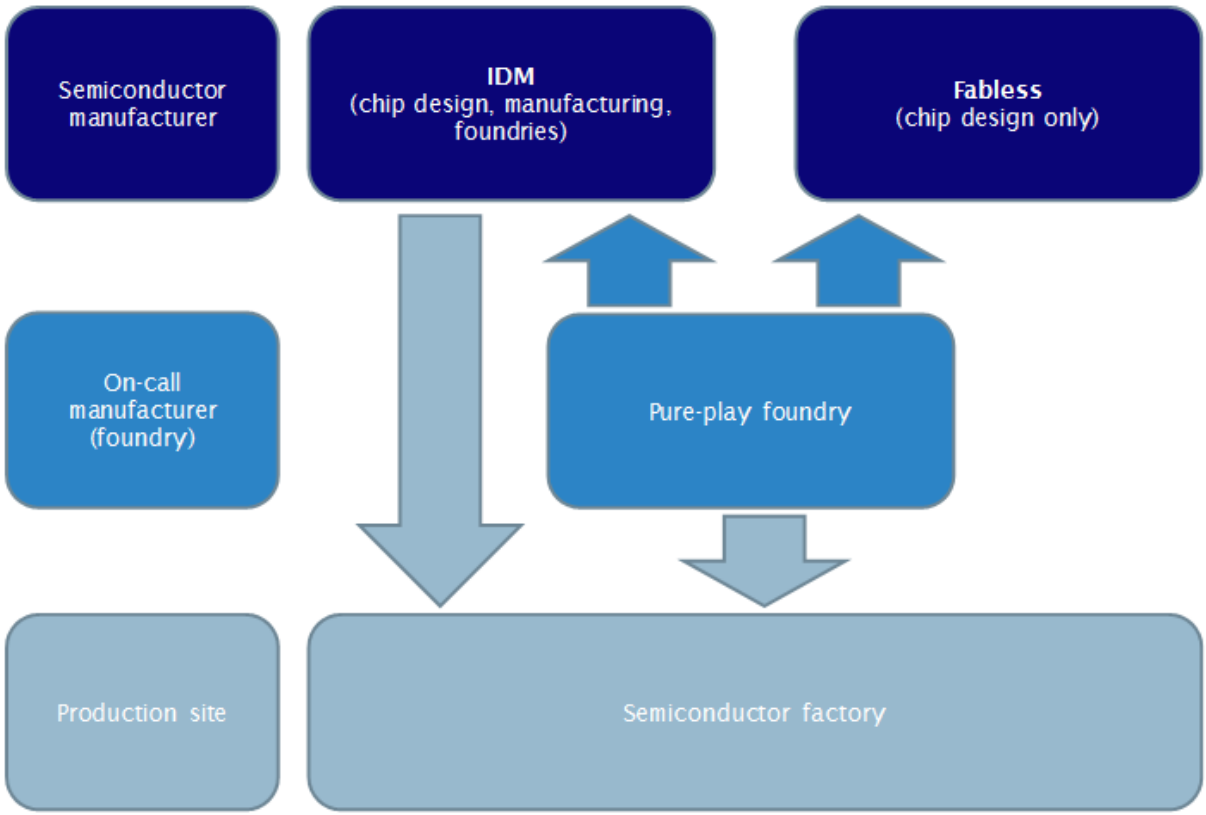


Especially in terms of the core part of the controllers – the micro-controllers responsible for the major functions – the trend towards outsourcing supply to what are known as “foundries” is at its strongest.

2| FOUNDRY MODEL MANUFACTURING.

Micro-controllers are developed by semiconductor manufacturers on the basis of architectures which are the framework for chip design. In the outsourcing process, production is passed onto **foundries**, who work to these designs and produce to their capacities. These on-call manufacturers are also called “**pure-play foundries**” because they do not engage in any development or marketing of their own and concentrate exclusively on production in state-of-the-art, in-vestment-intensive facilities.

If the semiconductor manufacturer produces some of its requirements in its own factories, then it is referred to as an “**integrated device manufacturer**”; manufacturers which do not have any production facilities and buy in all of their semi-conductors from foundries are known as “**fabless**” (“fab” is short for **semiconductor fabrication plant**); the only part of the process they engage in is developing the components.



As a consequence, in this model, the supply chain is lengthened to include the on-call manufacturer. This is, at first glance, not a negative development, encouraging decentralisation as it does, as well as making multiple sourcing possible in order to secure the supply chain; furthermore, given that IDMs also have their own production sites, there are several advantages to this strategy. Yet the trend among IDMs is to increase outsourcing, with more contracted out to manufacturers or even a move towards becoming entirely fabless. The supply relationships between foundries and some of the large semiconductor manufacturers is shown in the table below.

SEMICONDUCTOR MANUFACTURER	TSMC, Taiwan	UMC, Taiwan	Global Foundries, Singapur
Infineon	☑	☑	☑
Texas Instruments	☑	☑	
ST Microelectronics	☑	☑	☑
Freescale	☑		☑
NXP	☑		

3| RISK FACTOR: THE FOUNDRIES' MARKET POSITION.

When a closer look at the move toward the foundry model is taken, several pressing issues surface.

DEPENDENCY ON FEW MAJOR CUSTOMERS

Firstly, there are only very few manufacturers in the sector, which can quickly lead to market dominance, as in the case of the Taiwanese company TSMC, which already has a market share of more than 44% among foundries in the semiconductors sector.

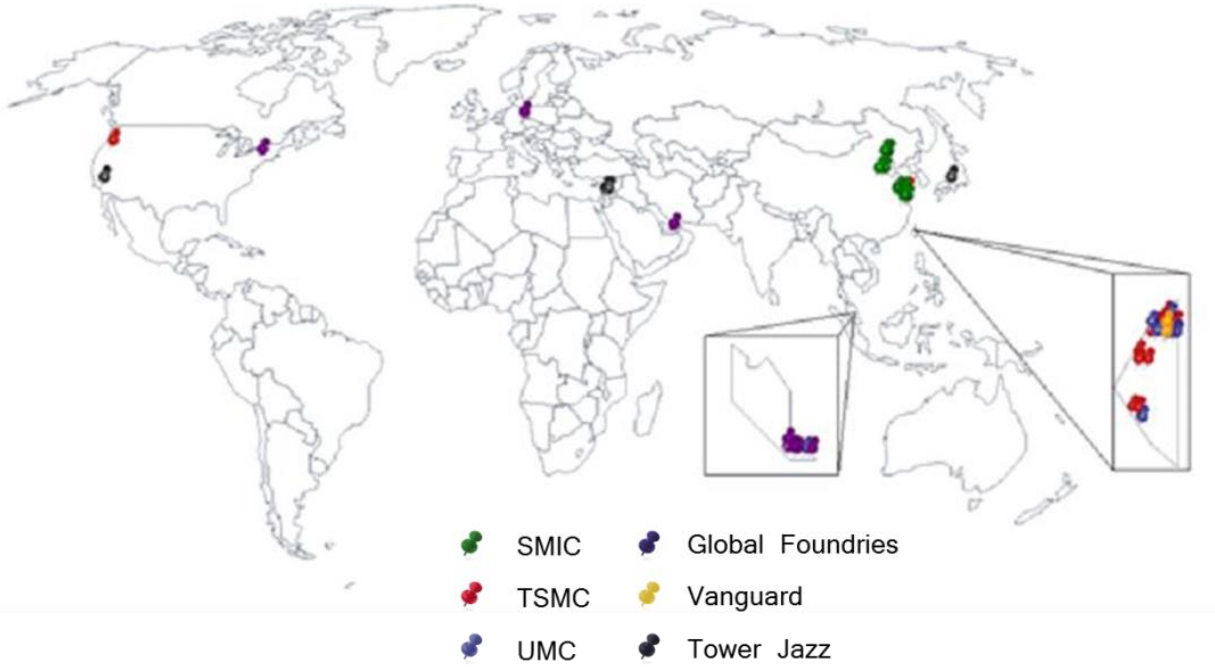
Yet at the same time, the foundries are very dependent on a small number of big customers, which also becomes particularly clear in the case of TSMC: between 2010 and 2012, the company's ten largest customers made up be-tween 55% and 60% of its turnover; the top customer alone was responsible for 17% of sales in 2012. This is a risk for other, smaller customers inasmuch as, if the key customer changes foundries, the prices for the others for

foundry service could be raised heavily at very short notice in order to compensate for lost sales and cover the extremely high fixed costs of the foundry.

CONCENTRATION OF PRODUCTION SITES

A further problem with the foundry model is the overweening concentration of production in East Asia: just three of the twelve largest foundries are not Asian. Moreover, a large number of these production facilities are located in very small areas due to the fact that several geographical conditions are re-quired to operate a foundry which are not given all over Asia i.e. sufficient energy generation and infrastructure.

The following map shows the production sites of several foundries.



Semiconductor foundry production sites (Source: Wikipedia, our graphic)

NATURE AS A SOURCE OF RISK

In the event of a natural catastrophe, the concentration of semiconductor factories in Asia can become an unresolvable supply issue. Natural catastrophes include potential dangers such as a contagious epidemic – e.g. apine or porcine flu – which can affect swathes of the labour force and lead to production stoppages. There are also other hazards, such as ever-present increased danger of fire or of other industrial accidents in the foundries themselves due to the use of volatile gasses or other dangerous chemicals in production. Mean-while, the production sites in coastal or island regions such as Taiwan, Japan, and Singapore are increasingly vulnerable to

extreme weather events and earthquakes leading to tsunamis and floods; such events can not only pose a danger to staff and facilities, but also to the logistics chains. As an example of this issue, in the 2012 fiscal year, IDM Renesas Electronis took a turnover loss of 22.4%, primarily due to the effects of the 2011 Tōhoku earthquake and the stoppages at damaged semiconductor production facilities it entailed; at the same time, the shutting down of nuclear power stations in coastal regions caused energy shortages, which curbed production even at production sites which had not been directly affected. On top of the costs caused by the stop-page, there were enormous costs caused by reconstruction and restarting production facilities. Just a few weeks ago towards the end of 2013, the destructive potential of Asian typhoon storms was once again revealed.

4| LIKELIHOOD OF STOPPAGES DUE TO CATASTROPHES.

In order to make clear the risks for automotive manufacturers, let us imagine a worst-case scenario: the most important manufacturing sites of the two big pure-play foundries, TSMC and UMC,1 fall victim to the next tsunami of the century (the two manufacturing complexes of TSMC and UMC are in Hsin-Chu (approx. 10km away from the coast) and Tainan (approx. 20km) respectively are around 200km away from each other on the west coast of Taiwan). Their production capacities are both primarily located in Taiwan, and that it where the tsunami hits them hardest, in turn leading to months of full production stoppages for electronics suppliers – especially in the cases of specific microcontrollers, the production of which has been contracted out completely to the foundries.

What would this situation mean for a German automotive manufacturer, for instance? According to calculations made by polariXpartner, in each mid-segment non-commercial use vehicle made in Germany will have at least one microcontroller from one of the two foundries (the precise average is 1.36). Due to the higher number of controlling devices included in luxury vehicles, the number of microcontrollers concerned here increases to three or four. Even in a dual-sourcing strategy scenario, the likelihood is that the silica supply needed for microcontrollers produced by these two tier-one companies – however different from one another they may be – will be affected.

5| RISK-AVOIDANCE STRATEGIES.

First and foremost, each automotive manufacturer should gain increased aware-ness of the possible risks for its own production: this makes a thorough analysis of the supply chain for semiconductor components – especially microcontrollers – an absolute necessity. This is even more crucial in the case of premium manufacturers, many of whom are moving towards prescribing microcontroller architecture to their suppliers. If a concentration on one foundry is indeed pre-sent, suppliers should be requested to produce their own set of measures for securing the supply chain; further to this, if a lack of foundry-diversity is ascertained, a move towards increased multiple sourcing is indispensable. This may however prove to be a challenge since, as noted above, the selection of foundries available is relatively limited.

POLARIXPARTNER advises clients in reducing risk factors in their supply chain, with the overall goal being a broad worldwide distribution of all key components. The combined experience of polariXpartner in managing electronics development as well as in optimising supply chains makes our company your partner of choice in this complex area of operations.

AUTHOR & YOUR EXPERIENCED CONTACT AT POLARIXPARTNER.

Hanns Peter Becker – Partner

- More than 20 years' experience as a project manager for technical product development
- More than 12 years' experience as a consultant in various industries – mainly automotive
- Expert on electro-mobility, especially development and sourcing of components for hybrid & electric vehicles
- Detailed knowledge of developing complex electronic control units, development process optimisation and R&D organisation design with a track record of successful cost optimisation programmes

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