

Business, Energy and Industrial Strategy Committee

Oral evidence: The Semiconductor Industry in the UK, HC 291

Tuesday 7 June 2022

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[Watch the meeting](#)

Members present: Darren Jones (Chair); Alan Brown; Ms Nusrat Ghani; Paul Howell; Mark Pawsey; Alexander Stafford.

Questions 23 - 45

Witnesses

[II](#): Alan Banks, CEO, TechWorks; John Docherty, Industry Expert, TechWorks; Jillian Hughes, Director, National Microelectronics Institute.



Examination of witnesses

Witnesses: Alan Banks, John Docherty and Jillian Hughes.

Q23 **Chair:** We are now moving on to our second panel. On the screen, we will be welcoming Alan Banks, CEO of TechWorks, John Docherty, the industry expert at TechWorks, and Jillian Hughes, who is the director of the National Microelectronics Institute. Good morning to all three of you.

Q24 **Mark Pawsey:** Good morning and thank you for joining us. One of the reasons why we are doing this inquiry is that we know that some UK manufacturers are suffering because of a shortage of semiconductors. In fact, before I came to this meeting, I attended an Industry and Parliament Trust meeting, where a major vehicle manufacturer mentioned that it had to stop the production line because it did not have the components that it needed. Can you tell us about the nature of the problem and how it has arisen? Is it an issue that is exclusively affecting the UK or is it a worldwide issue?

Alan Banks: Good morning. Thank you for the opportunity to speak. To answer your question, it is a global phenomenon. It is not something that is happening just in the UK and it is not affecting just the automotive industry. The reason the automotive industry is seeing it is it is a very large consumer of electronic devices and semiconductors that go into those devices.

The worldwide shortage has been caused by a change in the schedule. As a result of the pandemic, a lot of the automotive companies were reducing their schedules because the demand for new cars was going down. People were not able to buy them because the dealerships were closed and so on, so the manufacturers changed their schedules. At the same time, as a result of the pandemic and other effects, there was a rising demand for consumer electronics. People were working from home, so there was an increase in demand for laptop and desktop computers, video and gaming machines and so on, so the consumer electronics industry started to fill up the capacity in the semiconductor pipelines that the automotive guys were typically using.

Of course, when the pandemic then started to come to an end and the supply stream started to move again, there was no capacity left for the automotive guys to be able to put their schedules back to what they were, so they went to the back of the queue. What we have seen is quite a change in the dynamics of the way that the semiconductor industry is affecting the industry.

It is very much a global phenomenon. It is affecting not just automotive, but it is by far one of the biggest affected, and it will continue to do so. Our expectation is that the semiconductor shortage will continue through 2023, because the worldwide capacity just is not there. As you saw with some of your previous speakers, some of the chips are coming out of the UK. In fact, the UK supplies quite a large number of chips into the automotive industry, but the automotive industry is very much a global



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industry and takes its semiconductors from all around the globe. It is very much a worldwide phenomenon, not just a UK problem.

Q25 Mark Pawsey: You are suggesting that automotive has made the biggest noise because it is one of the biggest users, and it is more evident there. What other sectors in the UK are active consumers of semiconductors?

Alan Banks: Anything that is manufactured in the UK that has electronics associated with it. It could be medical, aerospace or consumer devices, as well as automotive. The reason that automotive probably makes more of a noise is because it is a bit more specialised in terms of the use of the semiconductors. Not every semiconductor is the same. Although it may provide the same function, it is not the same. In an automotive environment, the semiconductor has to operate in very high temperatures, where it might be sold in Arizona, for example, or very low temperatures, where it might need to be sold in Finland. Those semiconductors have to be qualified for very extreme operating temperatures.

Where you have semiconductors that are very specialised, that is why sometimes those are more constrained than some of the other semiconductors, which may have more of a natural drop in replacement. It may be that you may be able to change one semiconductor device for another and have the same function, but if it has being qualified for a specific environment, it may not be so easy to swap these components in and out. That is probably why the automotive industry is being hit the hardest, because of the specialist nature of the semiconductors that it uses.

Q26 Mark Pawsey: You have spoken about the lack of interchangeability of the components. Do we have any estimate of the cost to British industry of the shortage of supply that we have experienced over the past year or so?

Alan Banks: I do not want to put a figure on it. All I would say is that one missing semiconductor can stop an entire vehicle production in a manufacturing plant. Each plant is manufacturing maybe hundreds of vehicles a day, and some of these plants have been stopping for months on end.

Q27 Mark Pawsey: You have told us it is also not just vehicle manufacturers. Do we have a sense of the financial burden that businesses have had to bear through lost production because of the failure, if we might describe it as that, of this industry to provide an essential component?

Alan Banks: I cannot give you a number, but all I can say is that it is extremely high. You can imagine that, if any company that is producing very high-value products is unable to sell its products, it has a significant impact on that business.

Q28 Mark Pawsey: Is there anything that Government might have been able to do to assist UK manufacturers to get their hands on these scarce



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components that may have been scooped up by manufacturers in other countries?

Alan Banks: In all honesty, it is nothing that Government could do, because it is about the size of the market. Even though automotive is very high-hitting, it is a very small percentage of the number of semiconductors that are sold around the world. If you are a semiconductor supplier, you are going to supply to the guys that have the highest demand from you.

Q29 **Mark Pawsey:** Have our manufacturers missed out in relation to other manufacturers that are maybe bigger and have more clout around the world? Have they managed to get hold of these things in a way that ours have not?

Alan Banks: Do you mean other automotive manufacturers?

Mark Pawsey: In any sector.

Alan Banks: Not particularly. The consumer electronics industry has huge volumes. Semiconductors are typically going into those companies that have very high volumes. What we are seeing is that many more semiconductors are going into the high-volume manufacturers because of the scheduling. They can schedule very high volumes.

Q30 **Mark Pawsey:** So we would not have got more if we had shouted louder or paid more.

Alan Banks: No. Talking to my contacts, we have very senior people in very large automotive companies knocking on the doors of semiconductor companies, and they are not getting an audience because their volumes are not big enough.

Q31 **Alexander Stafford:** I really want to find out what major challenges are facing companies in the industry today and what the upcoming problems are. We talked about what the current problem is and where it is going, but are there any other upcoming problems or stumbling blocks that you can see in the next year or 18 months that have not been mentioned?

Alan Banks: Can I just qualify your question? Do you mean in terms of semiconductor supply or the industry in general?

Alexander Stafford: I mean semiconductor supply.

Alan Banks: The biggest thing that we are seeing at the moment is an impact on raw materials, predominantly from the situation going on in Ukraine and Russia. The development and creation of semiconductor materials requires a lot of inert gases and very high noble gases. Many of these gases are coming in from Russia and Ukraine, and so we are seeing constrained supply of some of these raw materials. We are likely to see a continuation of semiconductor shortages beyond the scheduling issues that were caused by the pandemic as a result of the conflict that is going on in Ukraine. We are likely to see an impact of that on the supply chain.



Q32 **Alexander Stafford:** On inert gases, can you give us some sort of scale of how big a problem this is? Is there a store in the UK and it is about to come up, or is it already having an impact? What percentage of inert gases come from Ukraine and Russia for semiconductors?

Alan Banks: If you do not mind, I will ask Jillian to answer that question, because she has previously commented on that on the radio.

Jillian Hughes: Good morning. Within the UK, one of the issues that was highlighted recently was neon gas. Within the UK, neon is not a process gas, but one used in the lasers that etch the pattern on to the silicon device. Impacts from a UK perspective are not that high in respect of neon gas, but there are countries in the world landscape that use a high percentage of neon gas coming out of Ukraine, so when they have supply issues, the worldwide issue is there.

In relation to other gases and raw materials that are used in the semiconductor industry, not just from Ukraine and neon, but, for example, hydrogen gas, which is a process gas that we do not have an abundance of here in the UK—we import it—when we are looking at supply chain issues within the semiconductor industry, we have to look at the whole market. We do not have a full supply chain.

When we talk about the supply chain, we are talking about design, manufacturing and packaging. When you look at the manufacturing side, and the equipment and raw materials that go into producing a silicon chip, we do not have a lot of the materials or gases here within the UK, so we are heavily reliant on supply chains worldwide.

Q33 **Alexander Stafford:** Just to clarify that, you are saying that, in the UK, we do not really have any examples of end-to-end supply chain for semiconductors. We are so reliant on the international markets and the world. Is that correct?

Jillian Hughes: Yes, that is what I am saying. We do not have an end-to-end supply chain. It is very difficult to say that we will have an end-to-end supply chain for the different types of semiconductors that we make here in the UK, because they are all different and use different base materials and processes. You would have to break it down into each technology area or each device to look at the supply chains independently.

If you look at the UK semiconductor industry, in maybe 80% of the processing of the technologies—whether it is compound semiconductors or a silicon chip—the toolsets are predominantly the same. It is the process steps that are different, so it is very complex and you would have to break it down into each of the different areas to look at the supply chain and at the gases, materials and chemicals used.

Q34 **Alexander Stafford:** For us, that is quite a worry, especially as we know what is going on in the international stage at the moment. Are UK companies not fully exploiting what we have in the UK supply chain? I



hear what you are saying about not being able to have an end-to-end supply chain, but if you say that we can have certain parts of semiconductors or certain aspects being made in the UK, are we fully exploiting what we have in the UK? Is there any more room for growth in the supply chain, or are we just stuck with the international markets and that is it?

Jillian Hughes: We have not seen any issues with the supply of gases within the UK, or very few. We have to wait until industry tells us of the issues that it is experiencing. Throughout the pandemic, the biggest issue has been capacity. There have been a few issues where companies have long lead times on raw materials or gases coming into the country, but I would not say that it has had a massive impact. We have still managed to reach our output and KPIs, but it is just something to be aware of in the future when we are looking at what Andy picked up on in terms of the framework of "own-access-collaborate". We have to be aware that we have to have relationships outwith the UK to ensure a steady supply chain of materials, gases and other things used in the processing of semiconductors.

Q35 Alexander Stafford: We have talked about the global ecosystem for semiconductors, but what parts of it does the UK do particularly well in regard to semiconductors? Is there any aspect that we are proud of and that we are world leaders in?

Jillian Hughes: Yes, we are world-leading in silicon design and advanced nodes, as well as our R&D, especially into new materials and, as was touched on earlier, graphene, compound semiconductors and diamonds. We have excellent know-how, skills and knowledge, albeit we are reaching an ageing population, and we are going to experience a skills issue and a skills gap. The know-how and experience that we have in the UK, which probably came from the 1970s, 1980s and 1990s, when we had Silicon Glen, should not be ignored. We have to build on that.

Q36 Alexander Stafford: You said you want to build on it and that we have a skills gap. How can we build on what we have, and what particular skills are lacking in the UK? Are those skills available in other countries and that is where the market is going, or do we need to train more people in the UK?

Jillian Hughes: We have to build skills in all areas of semiconductor design and engineering. We have to increase the content of semiconductors in some of our electronic engineering courses. We have a great charity here called the UK Electronic Skills Foundation, which does an absolutely fantastic job. We have to scale up foundations like that to help address the needs and skills of the industry.

Apprenticeships and graduate apprenticeships are absolutely great, but what we are experiencing within industry is the administrative burden of taking them on. We are reaching an ageing population within industry. There is a shortage of experienced design, equipment and process



engineers within the industry. Although companies would like to take on more apprentices or graduate apprentices, they are struggling because they have to provide hands-on training in that environment as well, so it is having a knock-on effect. Would they like to take on more younger people to bring through the industry? Absolutely—but do they have the bandwidth to do it? They do not at this moment in time.

We have to look at the content in the engineering courses, and we have to make it more attractive. Can we get students in from abroad? Yes, we can. We have already looked at the visa requirements to make it more attractive for engineers to come in, but the problem we have is whether we can retain those engineers within the UK once they are qualified and once they are here. That has to be looked at.

Q37 Alexander Stafford: Why can we not retain them at the moment? Is there better money elsewhere?

Jillian Hughes: Other countries then become more attractive.

Q38 Alexander Stafford: Is it financial—wages, basically—or is it other aspects that are better? Is it work-life balance or better research? What is the main pull to other countries?

Jillian Hughes: Probably life-work balance. A lot of people are motivated by salary as well, but it just depends on individual circumstances. A lot of students are coming here and being educated here at our universities, going into industry and then maybe leaving to go back to their home country.

Q39 Alexander Stafford: Are there any particular countries that are rivals and are pulling our students who we have trained up to them? Is there any particular country that we should be wary about?

Jillian Hughes: I do not know the answer to that.

Alan Banks: I would say that the United States is probably one of the most attractive. Given the option of working in London or California, some people would prefer to spend time in the sunshine. The wages that are offered, particularly in the US and some other countries, are more attractive than what a lot of companies can offer in the UK. As Jillian said, it tends to be wage-driven in many cases, but it is not just about wages.

We are seeing quite a lot of international students coming into universities, and the universities welcome them because they are typically higher fee-paying than the UK nationals are. The courses that we offer are good. What happens is that these students, typically, over time, will gradually migrate back to their home countries, so we lose that skill that was created in the UK.

It is also true in some other countries. For example, when we create intellectual property in the UK through our design activities, we are not doing enough to retain the intellectual property in the UK. What is happening is that, over time, we are seeing acquisitions of small



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companies, because they are struggling financially in the UK, and we lose some of that intellectual property overseas. Over time, some of this skill set and intellectual property gets eroded.

John Docherty: The attractiveness of technology and advanced technology—deep submicron—is massive to the engineering community, in design and manufacturing, across the board. Equipment guys will locate in other countries. That attracts a lot of our people. You can go anywhere in the world and meet UK talent who have left the industry in the UK or started somewhere else. The big investment that companies like Intel make in Ireland, and that other companies are making in the USA right now, is a massive attraction for the young graduates coming out of the UK.

Q40 **Paul Howell:** I have a similar question but on a slightly different subject. Rather than talking about skills, we are talking about facilities. Where does the UK sit? Are we batting above our level? Are we about where we should be for a country of our size? Can you give us a sense of what we should be doing?

Alan Banks: The UK is a very good country in which to create a silicon environment. We have a good climate. We are surrounded by water, which is very important in the manufacturing process. We have a stable Government. We have very good environmental conditions. We do not typically have earthquakes or other environmental impacts that some other countries around the world have. We have seen the impact of some of these natural disasters that have happened over the last few years, in particular in Asia. The UK, geographically and politically, is a very strong country to base ourselves. That is the first point that I would just like to make. As a country, we need to make more of that. We need to be singing and praising our country in terms of where we sit in the world, both geographically and politically, and trying to attract more inward investment.

In terms of where we are on the global stage, we are tiny. In 2021, the global semiconductor industry was worth about \$550 billion in sales. That is expected to increase to about \$600 billion in sales this year. We are about 0.5% of that, so we are tiny in terms of the size that we are. As we said earlier, we have about 25 manufacturing facilities in the UK, but we do not provide finished goods out of those factories. What we tend to do is we import some base materials and do some initial etching, as Jillian said, and some other basic functions. That then goes offshore to be finished into another product to be packaged. Then it will come back into the UK into another product, which may end up going into an automotive application, a power application or whatever that may be.

To answer your question about where we sit on the global stage, it is very high in terms of our capability. In terms of our footprint, it is very low at the moment.

Q41 **Paul Howell:** It sounds like there is a little bit of a conflict there. You are



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saying that we are a good place to do it. We have a lot of opportunities and resources, and the right environment, whether political or physical. How do we get it to move forward from there? We have talked in the previous session about the UK and where things are fitting, but how do we get ourselves into a better place—either fitting better into international supply chains and doing things differently, or collaborating with partners? Why are things not going stronger and faster in the UK?

Alan Banks: To be frank, what we need is a UK semiconductor strategy and we need to be very clear on what products we can do here and what products we probably will never do here. As the previous speakers have told you, the cost of investment to create one of these factories is enormous. It is really high, so it is very expensive to create a manufacturing facility for semiconductors. You have to have a company that has the capability to invest in such large manufacturing scale.

As mentioned earlier, Taiwan has TSMC, which is the largest fab in the world. We do not have anything like that in the UK, but what we do have is a lot of small, but legacy, fabs. They produce high-quality output, but they are really niche applications. We need to map out what the product requirements are for the world and agree what products the UK should be really focusing its effort on. The UK Government and industry should then get behind this strategy to say, “These are the products that we are going to support. These are the ones that, realistically, are affordable for companies to invest in the UK and for the Government to support, to create these industries and keep them going”, and then we can continue to have our presence on the global stage.

We do not believe that it is feasible to ever create something like TSMC in the UK, because, frankly, the UK Government do not have the money to make such a large investment, and we do not have companies that are coming into the UK, because they are not really being incentivised to do that.

We need a strategy. We need to be clear on what the products are that we are going to focus on. We then need to get behind that—both Government and industry collaboratively—to work together and to make sure that we move this forward and create an environment that is there for the long term. This is not a short-term fix. This is investment for our future generations. We need to sustain economic growth, job creation and employment for our children and our grandchildren.

Jillian Hughes: Talking about where our strengths are in the UK, we have 25 fabs. The focus in the previous session was on the compound semiconductor side, but we are also very strong in silicon. Although we do not have leading-edge silicon manufacturing here in the UK, if you look at recent reports, we produce over 50% of silicon chips above the 180 nanometre node size that are manufactured. That is exactly where we play into in the UK. We do not have to have leading-edge node size in the UK. If there is a market case and a business case for it, why would we not look at it? We can play into the markets that we are strong in just



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now, and we can scale them up, as Alastair said in the previous session, with targeted investment.

If we are looking at the net zero agenda, not every single chip that goes into an electric vehicle is going to be a compound semiconductor chip; you still have to have the silicon, you still have to have the other. In the UK, we are strong in photonics, sensing, comms and powered electronics, and we are looking to scale up the photonics and compound semiconductor sectors.

Clas-SiC in Scotland cost £60 million to build. With £20 million of investment, it can treble its production capacity. It is just to give you an idea of what the value of investment is to triple capacity. We go from low capacity to medium in the compound semiconductor space, which is feeding into the net zero agenda through the electrification of vehicles, so it is worth putting that into perspective as well. We do not need leading-edge node sizes. We have niche markets here in the higher-end, mature silicon as well.

Q42 Paul Howell: Thanks for that clarity. Just to develop that thought a little further, one of the things that we have all been concerned about over the last year in particular, with Ukraine, and previously with the pandemic as well, is UK resilience. In terms of the partners that are out there—where we can get supply from for the more leading-edge pieces—we have the partners that are producing. Are they ones that we would class as being, for want of a better phrase, friendly in the long term, where we would see worldwide resilience to our supply chains?

Alan Banks: We are dependent, as we said earlier. We do not have an end-to-end supply chain, so we are very much dependent on raw materials and other elements from around the world. As part of the strategy, we need to make sure that we are aware of the geopolitical situation. We are very nervous about TSMC because of its position in Taiwan and the potential threats that it could face. If TSMC was to lose its ability to supply chips around the world, it would take three or four years for the whole world to be able to create what comes out of Taiwan. That would cause a massive shortage, so we need to be aware of where the chips and the raw materials are coming from. We need to be very clear on what the supply chain is.

As we mentioned earlier, we have conflicts all around the world. We have different elements coming from all around the world. We need to be very clear on those countries that we want to partner with and that we have strong political ties with—as you said, friendly nations that we want to be able to secure—but that needs to be very much written into contracts that say that the UK needs to be able to secure a supply chain, particularly for semiconductors that are going into communications infrastructure and power infrastructure—those infrastructures that are national requirements for the country.

Some of these things are absolutely critical and, in some cases, there



may be some vulnerability in the supply chain. We need to do some research to make sure that we fully understand where all of those raw materials are coming from for products that are coming into the UK, and what the potential impact could be. Effectively, a disaster recovery plan needs to be put in place, so that, in the event that we see issues with a particular supply or a particular country that provides supply, we have alternative supply routes in place.

Q43 Paul Howell: Semiconductors are obviously important, but is there something coming that is going to replace them? Is there something out there that we should be stepping ahead of the game on? Is there a different type of supply or different type of manufacture? We all have seen industries that have just risen and fallen and gone away. Is there something else that we should be aware of that is going to come into this space, or is that just farfetched at the moment?

Alan Banks: "Who knows?" is the honest answer. We do not know what we have not discovered yet.

Paul Howell: We do not know what we do not know.

Alan Banks: All that we can say is that, even with the advent of things like artificial intelligence and all of the new computing technologies, all of this requires some form of electronics to run on, and all of those electronics require a semiconductor to provide the underpinning circuits that are required to run it. Even at the cutting edge of technologies that we are developing now, there is still a requirement today for some kind of conductivity device, whether it be a semiconductor, a compound semiconductor, a diamond or whatever the material used for that connectivity is. At the end of the day, it is connectivity. They are all just tiny little electronic circuits that are getting smaller and smaller.

Q44 Chair: As a final question from me, we have heard evidence from you and from our previous panel today that there should be a new overarching strategy from Government on semiconductors. There should be a disaster recovery plan if, for example, exports from Taiwan become constrained because of geopolitical issues. We are observing that the Government here are intervening much more around national security assessments in different parts of the supply chain in assets that we have in the UK.

Just lastly, on that piece around the national security assessments, is that increasing or decreasing confidence for investment in the industry in the UK, or is it too early to know?

John Docherty: It is too early to know. I do not think that, for people who want to put money into the UK, that would be the prime requirement that they would consider. They would look at multiple supplies and then see how they can ringfence the security aspects of that around them. Again, I am not an expert in that space. It is just my thought on that.

Q45 Chair: In the final minute, just for my understanding, Alan, you said that we would never be able to rebuild the production capacity in Taiwan in



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the UK without spending a huge amount of money. There is a concern around exports being constrained from that site. Where else would we go if we could not get it from that site in Taiwan?

Alan Banks: Japan and Korea have similarly sized facilities, but TSMC out of Taiwan is the dominant one at the moment. We are seeing a rise in others. The European Union has just invested a significant amount of money in its semiconductor strategy, so within Europe we are seeing the European Union start to invest quite heavily in the growth of semiconductors to try to offset some of these issues and to create capacity elsewhere in the world.

It is a dynamic situation. The current situation is that TSMC is dominant in the market, but there is no reason to say that that cannot change as other countries and companies invest heavily to try to increase the capacity around the world, which is what we need to see. We need to see that diversification and ability to have a contingency around the world.

John Docherty: If I can just enlarge on that a little bit, TSMC is now diversifying outside of Taiwan. It has diversified inside in different locations. Singapore is now regaining prominence. It stopped investing a number of years ago but started reinvesting heavily in wafer fab capacity. There is an awareness of the cluster that is in Taiwan, and some of the political vulnerability that goes with that.

Chair: Thank you for that and to all of you for your contributions this morning. Alan Banks, John Docherty and Jillian Hughes, thank you so much.