Taiwan & Netherlands

insights through data

Michelle Chan

Netherlands
Office Taipei
荷蘭在台辦事處

Netherlands
Innovation
Network

- Focused on patent and trade data to create a comprehensive overview of innovation trends in Taiwan in areas that are relevant to us: semiconductors, photonics and digital technologies.
- Use data to back up our claims: How big are we actually in semicon, what are the strengths of Taiwan, what are the strengths of the Netherlands (are we actually a big player in integrated photonics).
- Also, what dependencies do we, Netherlands, have on Taiwan?
- To answer those questions: Trade data, patent

data (also did some on research publications, but in the end I only focused on the other tw)

Export
Netherlands to Taiwan

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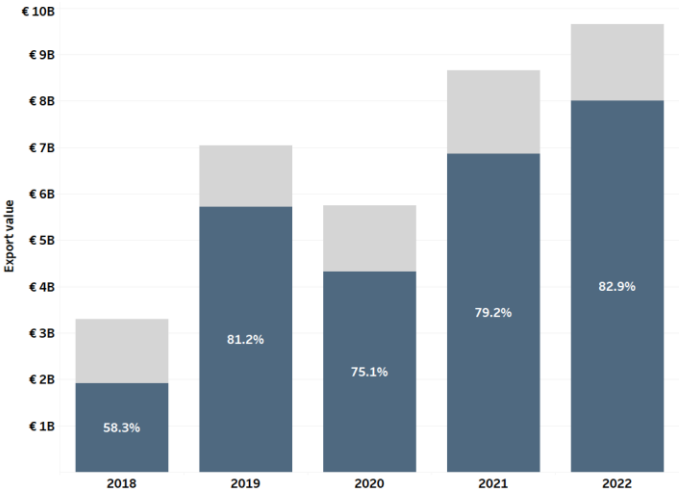
Intern gebruik

Export of Dutch goods: part I

- Between 2018 and 2022, the value of Dutch goods exports to Taiwan increased more than threefold.
- Dutch export to Taiwan is dominated by one category/product:

Semiconductor Manufacturing Machines



Intern gebruik

src: Taiwan Bureau of Trade

- Between 2018 and 2022, the export of Netherlands to Taiwan has increased threefold(updated March 2023)
- The Dutch export is dominated by one specific category, which makes up around 80% of the total Dutch export to Taiwan since 2019": **Semiconductor Manufacturing Machines (not chips itself).**

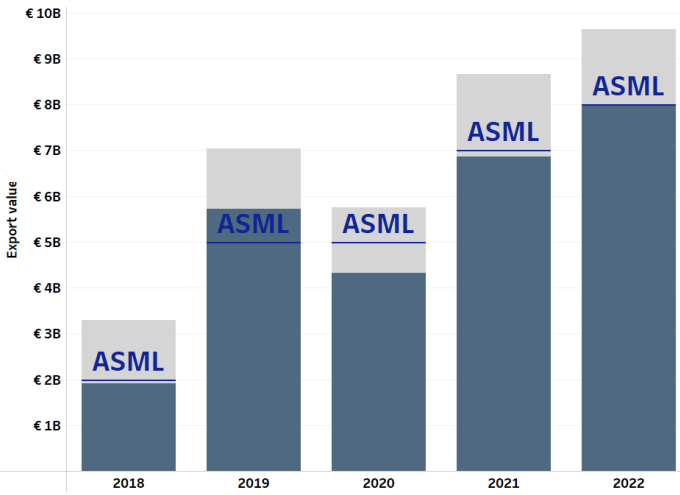
- Re-imports & re-exports included, because this is not possible to exclude.

- Gray area indicates the other categories (made up of a lot of different small ones)

Intern gebruik

Comparison of machine export to ASML net sales

- ASML's net sales are equal to or higher than Dutch semiconductor export
- Possible causes:
  - Export trade data is only about **goods**
  - ASML net sales include **services (795M in 2020)**



src: Taiwan Bureau of Trade

Intern gebruik

Let's look at our friends of ASML, the largest within this field of semi.

- We compared ASML's net sales to our export data.
- We see that ASML's net sales are similar to the Dutch export in semiconductor manufacturing machines, or **even higher** than that (e.g. 2020 ASML net sales goes over the export of semiconductor machines)
- Why is that?
  - This is because ASML's net sales consists of goods as well as services, whereas the export data/graph only includes exported GOODS.

ASML net sales across the years (exact)
2018: 1.98 B
2019: 5.345B
2020: 4,732B
2021:7.328B
2022: 8.1B

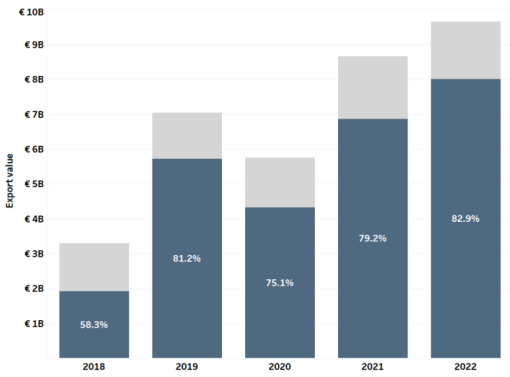
Export of services to Taiwan:
2020": 795M (=services)

Intern gebruik

Export of Dutch goods: part II

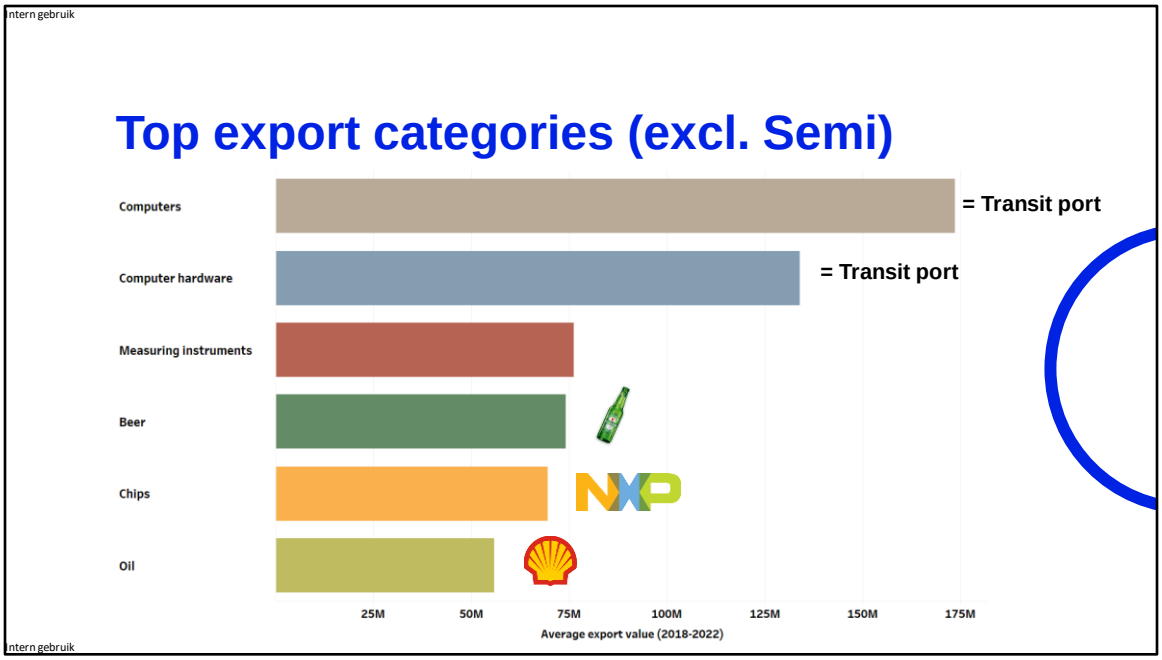
What is the other 1-1.5B euro of export goods each year?

A.K.A the grey area



Intern gebruik

Although small in comparison to ASML, or export of semiconductor manufacturing machines in general, each year, we export around 1-1.5 B euro in other export goods. This is definitely not small.
Let's look into the other goods.



- From 2018-2022, these are the top categories based on average export value.
- The export of computers and computer hardware is high, but this is not something that NL is known for. This is very likely **re-export**, meaning that NL is used as transit port for other countries to export to Taiwan.
- Data includes re-export.
- Other interesting thing is that Taiwan is one of the biggest market

Import
Dutch dependencies on Taiwan

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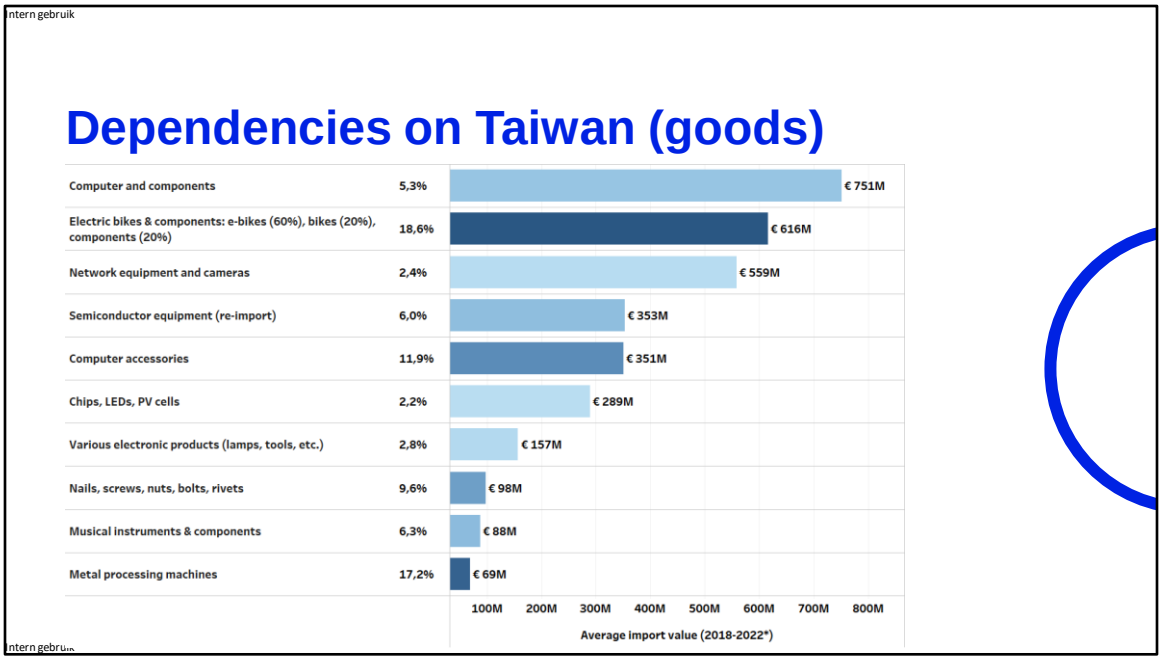


- In this graph, we see the largest categories of goods in the years 2018-2022 (october) based on the average import value of the category based on data by **CBS.**
- The Netherlands imports computer components, electric bikes, and network equipment which amount to the largest categories based on the value.
- However, to measure our dependency of this category, we have to look at what the % is that we import from Taiwan within this category.
- For example: We have a higher dependency on bikes than on computer components (resp. 18.6% vs 5.3%). **This means that we 18.6% of our import regarding bikes is from Taiwan!**

- The names of these categories are ones that we have given them. The original category names by can be vague and broad (e.g. *automatic processing machines* is used for laptops), and we tried to match the numbers found in CBS data to Taiwan trade data (which is more specific).

- What is meant by *matching the numbers*: There is **X** euro in CBS for Network Equipment, but we don't know what is meant which can be seen as subcategories. By summing up the possible subcategories, we look at whether it equals the **X** euro.

- In the case of network equipment, it might likely be wifi routers, but the matching was uncertain (not equal to the amoun in CBS). So, we didn't specify it further. For bikes, you can actually see the subcategories of Taiwan's Trade office data matching the overarching category for bikes in CBS.

Dependencies and categories

- **We have a high dependency on bikes, computer accessories and metal processing machines**
- Fact: For bikes, we export from Germany (27%), China (14%) also. There is a graph of this in IA dropbox.
    - Companies: Giant, but also VanMoof who produce their bikes in Taiwan
- Semiconductor equipment is odd, since Taiwan doesn't do anything with equipment –we do-. It is likely that equipment gets exported to Taiwan from NL, so a specific part can be added and then exported back to NL. (e.g. reticle handle added to EUV machines)

- For chips, LEDs and PV cells, it is mostly chips.

CBS data; includes re-import

Semiconductors
Patents

Netherlands Innovation Network

Introductory of patents:

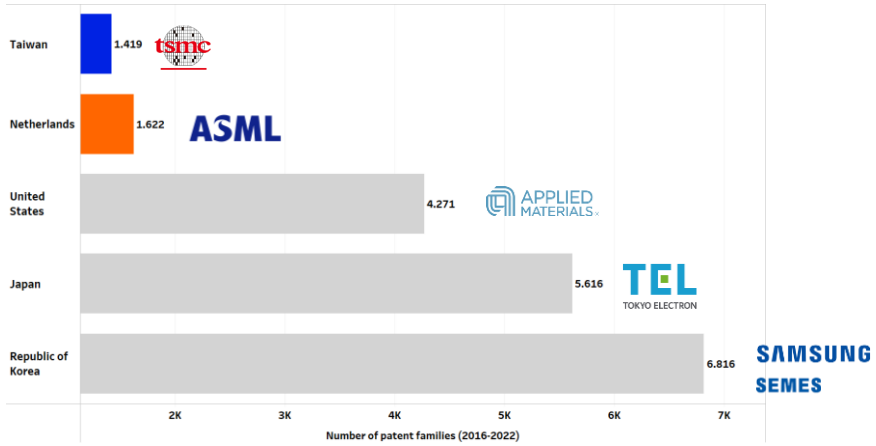
- What is a patent?: **A patent is an exclusive right granted for an invention, which is a product or a process.**

Patents give an indication of how innovative a country is in a specific field.

- A patent family is a collection of patent applications covering the same or similar technical content. Applications in a family are related to each other through priority claims
    - One patent family is basically one unique invention

If we have more patent families, we have more inventions . Therefore, **we count the number of families to indicate how *innovative* a country is in a field**

Semiconductor Equipment



Semiconductor equipment refers to manufacturing equipment used for the fabrication of semiconductor chips. This is an area that Netherlands is known for/that is Netherlands' strong suit. (ASML).

So let's look at what the patents have to say.

% patents of World

Taiwan's patent families in equipment is 2% of the world in semiconductor equipment.

For NL the patents in equipment is 2,5% of the world. Not that much more than Taiwan.

Why is that? Let's look into it through the biggest companies that have applied or have been granted such a patent.

Companies

- TW: **TSMC (73%)**

This is an odd one, because TSMC actually doesn't do equipment. Question is: *Why do they still show up?*

Likely explanation: For the semiconductor proces, tweaking is still required. Even

though they don't make equipment, they still **use** equipment **within their process** which is why it needs a patent.

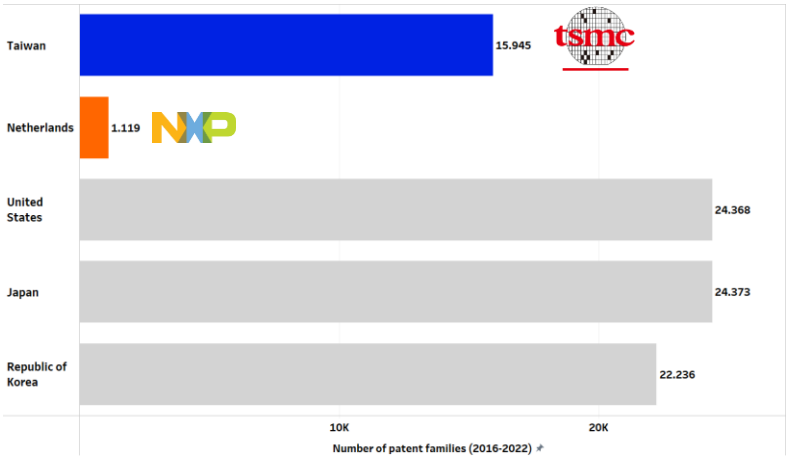
- NL: **ASML(77%)**

Semiconductor Equipment is something in the industry in which Netherlands is "strong" at, but **why isn't this necessarily showing in patents?**
Likely explanation: ASML does one step in the semiconductor process that is **highly profitable** but **does not necessarily yield most R&D/patents.**

Now we've seen Netherlands' strength, how about Taiwan?

Intern gebruik

Semiconductor Manufacturing



Intern gebruik

Taiwan is particularly known for semiconductor manufacturing, and it shows.

% patents of World

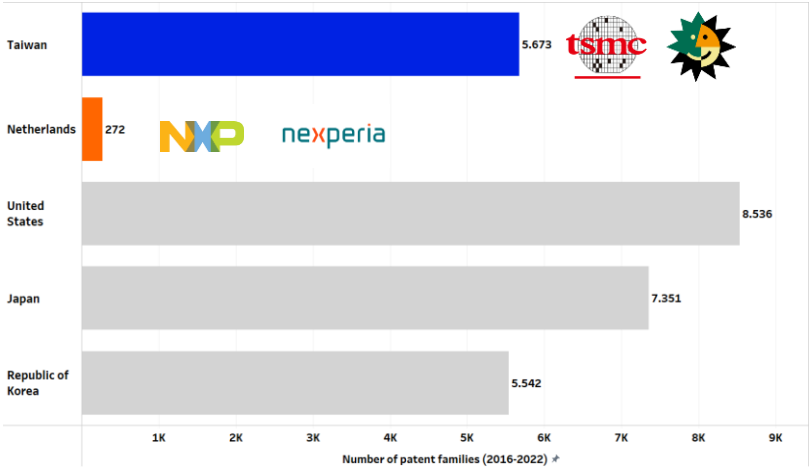
- Taiwan **8%** of patents within this area
- NL has only **0,5%**.

Companies

- For Taiwan, TSMC has **46%** of the patents in Semiconductor manufacturing. Other companies include UMC **(5%)**
- For the Netherlands, the patents are more evenly distributed across companies: NXP owns **17%,** Lumileds **(11%),** ASML **(10%)**

Other companies/organisations include Nexperia, TNO, Signify. Exact amounts can be found in excelsheet.

Semiconductor assembly & packaging

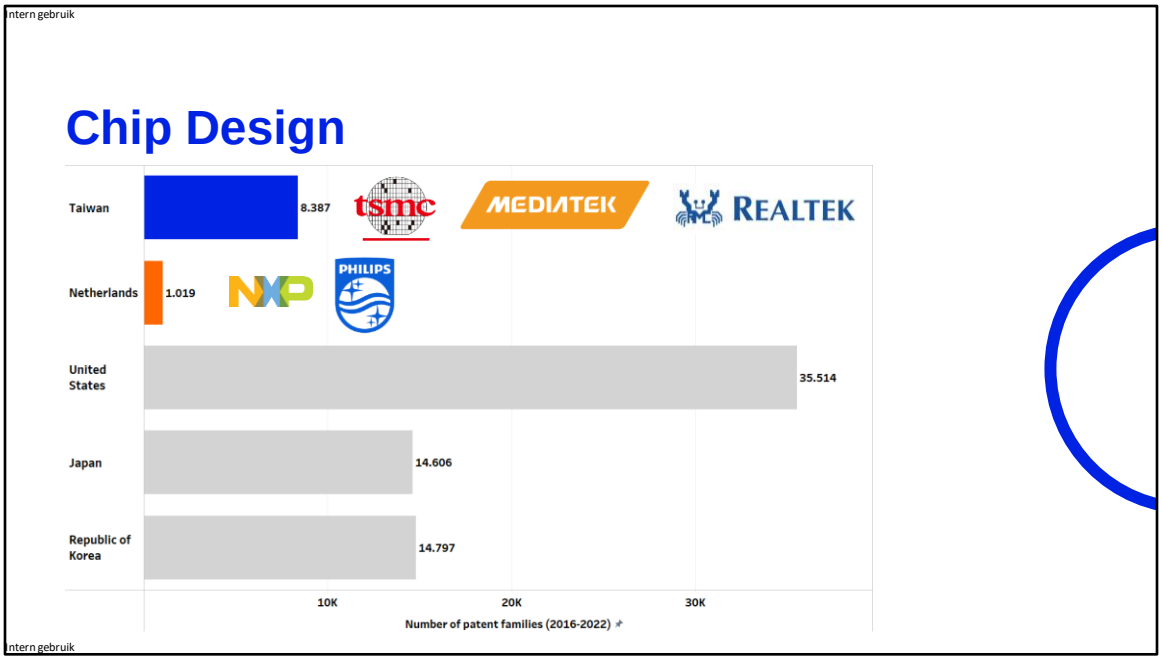


Taiwan has another strong suit: backend of chips. Prime example of assembly & packaging.

% of World
- Taiwan has **10,5%** of patent (families) of the world
- Netherlands has **0,5%**

Companies
- Taiwan: TSMC **(55%),** ASE **(11%)**
- Netherlands: NXP **(29%),** Nexperia **(18%),** ASMI **(10%)**

ASML **(6%).** Other companies include Ampleon, St Microelectronics and Besi.



Taiwan also has it's fair share of chip design. With 5% of patents in the world.

Especially here, we can see that Taiwan is more than TSMC **(27%).** Also, Mediatek **(8%)**, and Realtek (**6%)**

For NL, NXP **(42%)**, Philips **(16%),** other companies include Signify and TNO.

Integrated Photonics

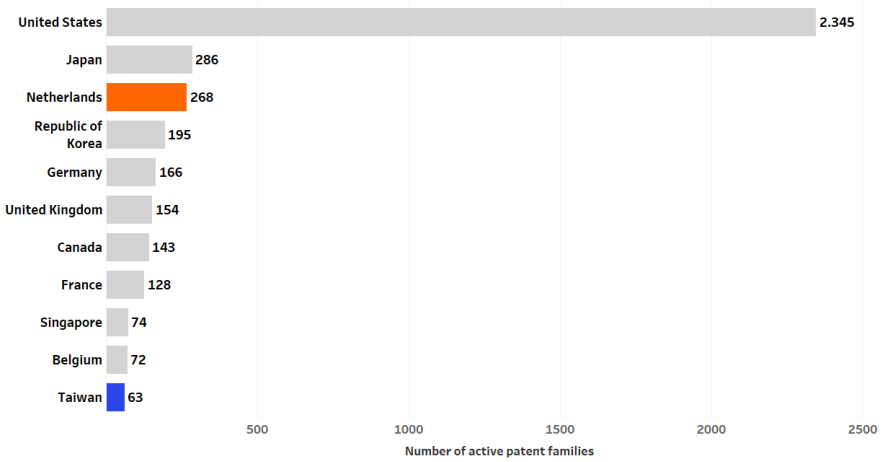
Patents

Netherlands Innovation Network

- Photonics is a priority for our office
- Check what the status of photonics is in NL, and see whether we could use this to show our strengths for promotion purposes

Intern gebruik

Top countries with most active patents



Intern gebruik

This slide can be used as a promotional slide to show our strength in integrated photonics. From the top countries (most active patents) within this area, **Netherlands is #3**. Very close to Japan. Active patents are patents that have been granted or are in application phase.

The United States has around 45% of all active patents in this area.

Number of active patents in the world in this area: 5242

Digital technologies
Patents

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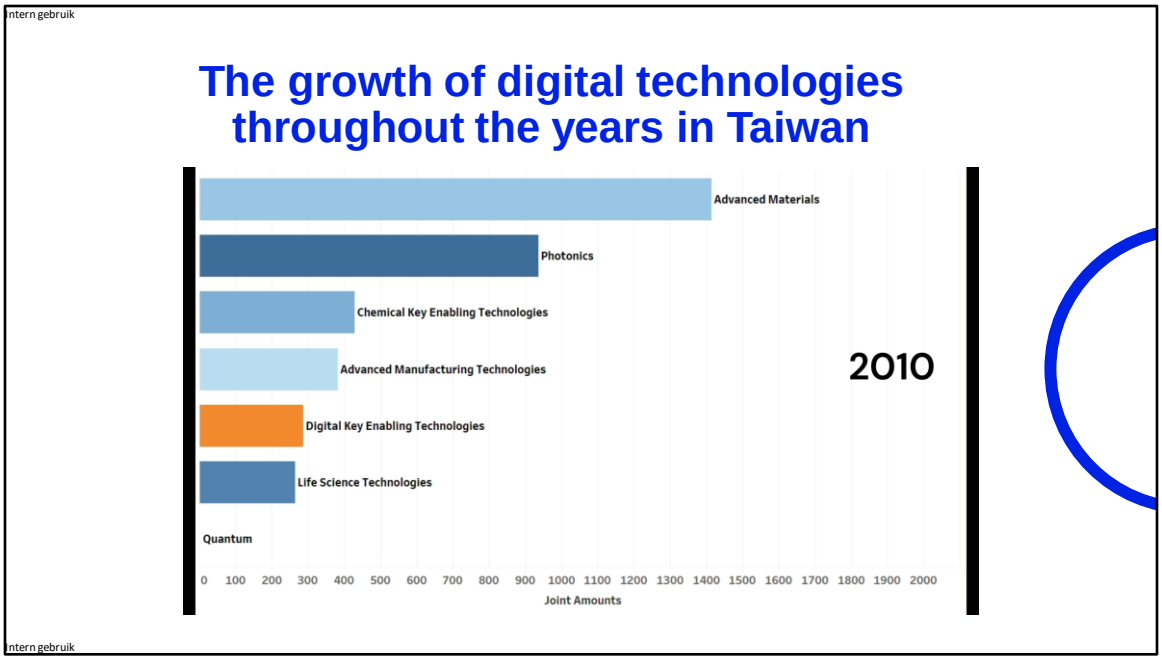
Digital technologies has grown immensely over the last couple of years.
Within this category, you can think of artificial intelligence, big data, cloud computing and all the *digital buzzwords.*

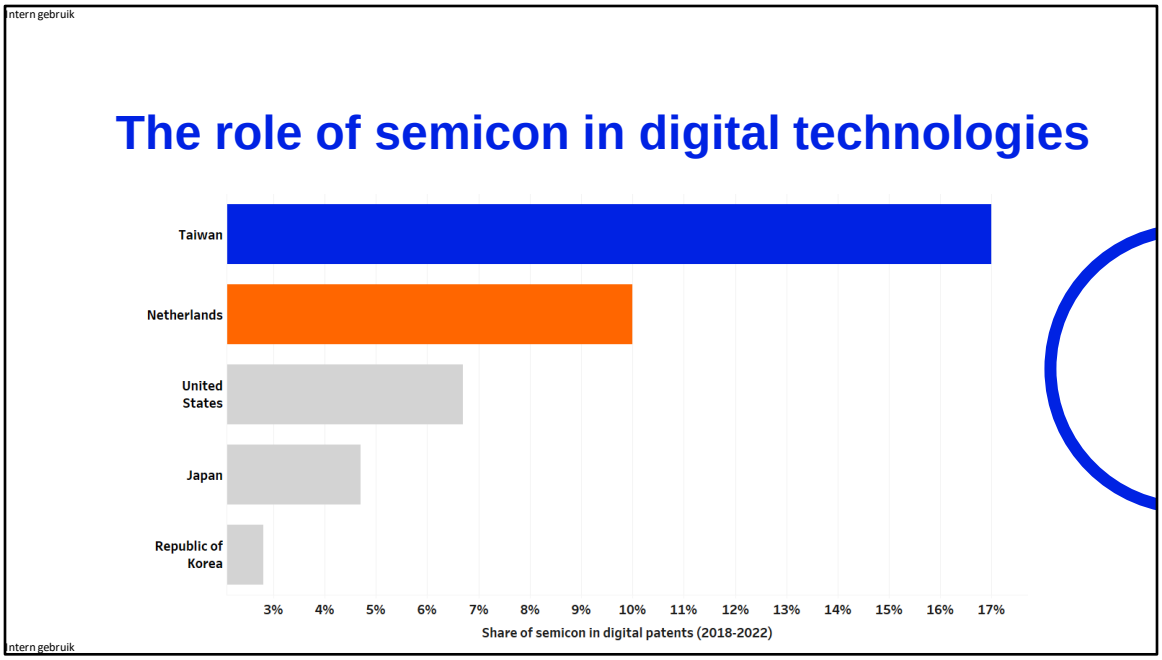
Although Taiwan is not necessarily known for this part, it can still be of interest for us to analyse this.
Also, we had some indications that Taiwan hardware industry is increasingly working on software, so we looked at patents to see if that is actually the case.



This video shows the growth of digital technology throughout the year, based on the rising amount of patent families that are granted and applied for. (Joint amounts just refers to patent families)

Nanotechnology category (=semiconductors) is excluded here (that category is way bigger than these ones).

We see that digital technologies has become increasingly popular in Taiwan, and especially the jump from 2018 onwards is interesting to see.



We know that Taiwan is a country of hardware, who maybe wants to shift to software.
So, how do hardware and software relate to each other in Taiwan?

For this research, we looked into the patents regarding semicon, as well as the patents that fall into digital technologies, and then counted the ones that both share. Meaning it falls both in semicon category as well as digital technology. We divided the overlapping patents with the total of digital patents. **This shows us how hardware is integrated into software (digital) patents.**

This hardware relationship to digital technology patents is especially contrasting to the United States, which is really a software country.

We can also see this from the organisations who filed for these patents.
On the Taiwanese side, the patents are filed by ITRI, TSMC, Wistron and Foxcon (mostly hardware companies), whereas the US side is filed by IBM, Microsoft, and Google (software companies)

For NL, it is actually Philips.