The impact of digital transformation in the automotive supply chain in Mexico

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The search for security under disruptive technologies and deconstructed labour markets
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Motivation

- A 4th industrial revolution in automotive?
- Major technology-driven trends such as autonomous driving, electrification, car connectivity and multimodality are predicted to lead to the biggest transformation of the industry since the invention of the car in 1885.
- Industry 4.0 stands for a new level of organization and control of the entire value creation chain during the life cycle of products.
- Technology adoption varies across actors in the automotive industry supply chain mainly based on companies' size…
- Key challenges for digital innovation include standardization, data security and employees' skills.

Outline

- From the Oecd WPTIP project on "Digital and open innovation"
  https://www.innovationpolicyplatform.org/digital-and-open-innovation-project
- To the follow up on the digital transformation in the automotive supply chain in Mexico
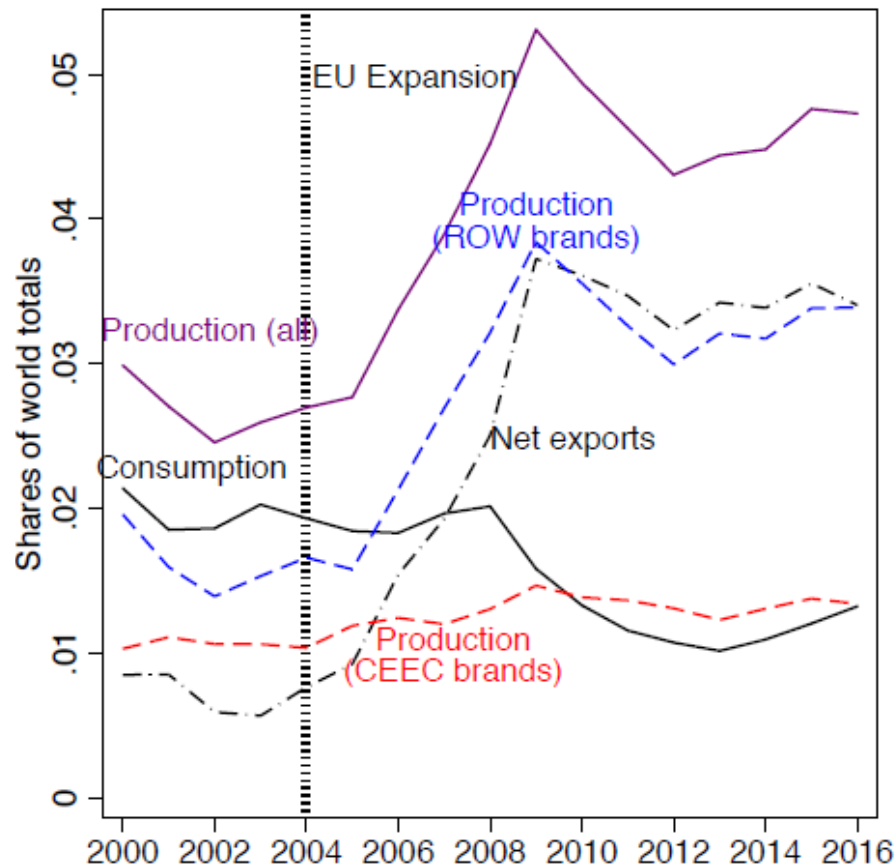
Research questions
  - How do digital transformations emerge across countries and industries?
  - How do they enhance the working of the economy and society?
  - Which are the new emerging actors? Which competences and skills are needed?
  - Which are the new opportunities for mutual learning, across countries and industries
  - The different pace of changes in the various countries

→ Focus on cross sector interrelations
  Interrelations matter because they mark the pace of changes within the many subsystems (energy, transport, industry, public administration, …) in the sociotechnical & economic systems

→ Case studies: to frame the concepts about digital transformation and to analyse its impact
  - Big data in Japan, Industry 4.0 in Italy, Automotive supply chain in China, Germany, Italy
  - **Automotive supply chain in Mexico**

→ What to expect from this study?

Why Mexico?

- Mexico, is an important case study for several reasons.
- Until the mid-1970s car and truck production for North America was mainly located in the US: large scale, highly concentrated, vertically integrated oligopolistic companies.
- After NAFTA and Mexico's liberalisation, the auto industry has relocated partly to Mexico. Big car makers responded to global challenges by taking advantage of low wages, fiscal concessions and other facilitations following the opening of the Mexican economy. Its cost advantages and its privileged access to the US market attracted many car makers from Europe, Asia, the US.
- In 2018 Mexico ranked **seventh** among producers at the world level, and the automotive industry represents a relevant share in the Mexican economy, both in terms of employment and as a share of GDP.

The growth of the periphery (Mayer and Head 2019)

(a) Central & Eastern Europe (CEEC)

(b) Mexico
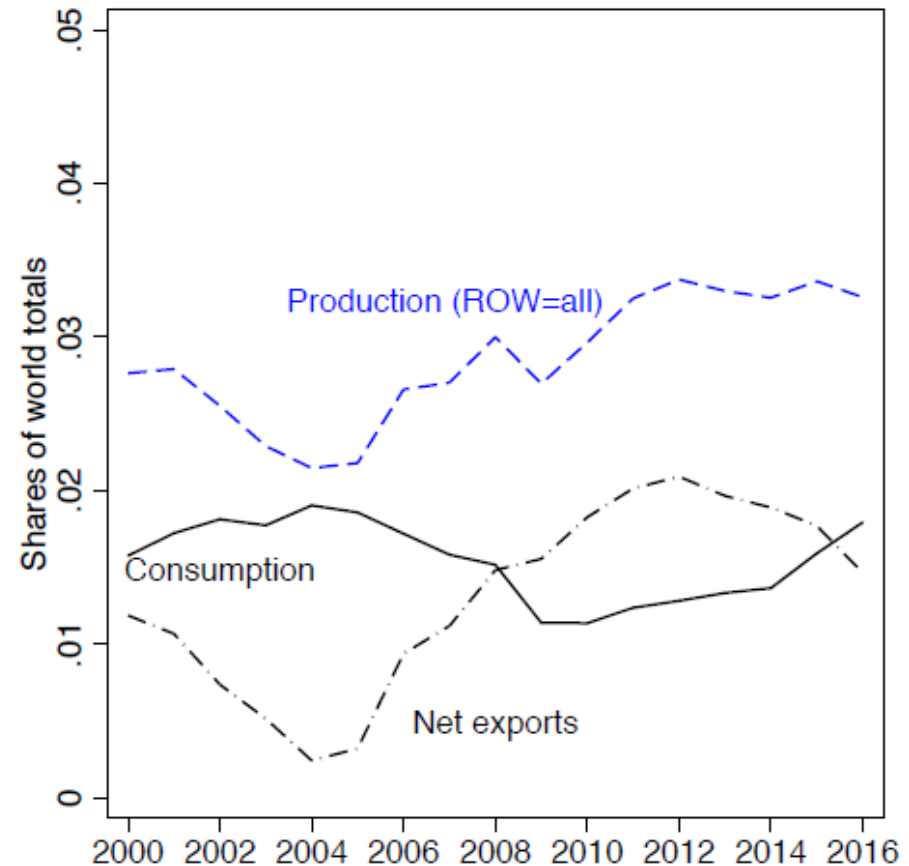
The growth of China
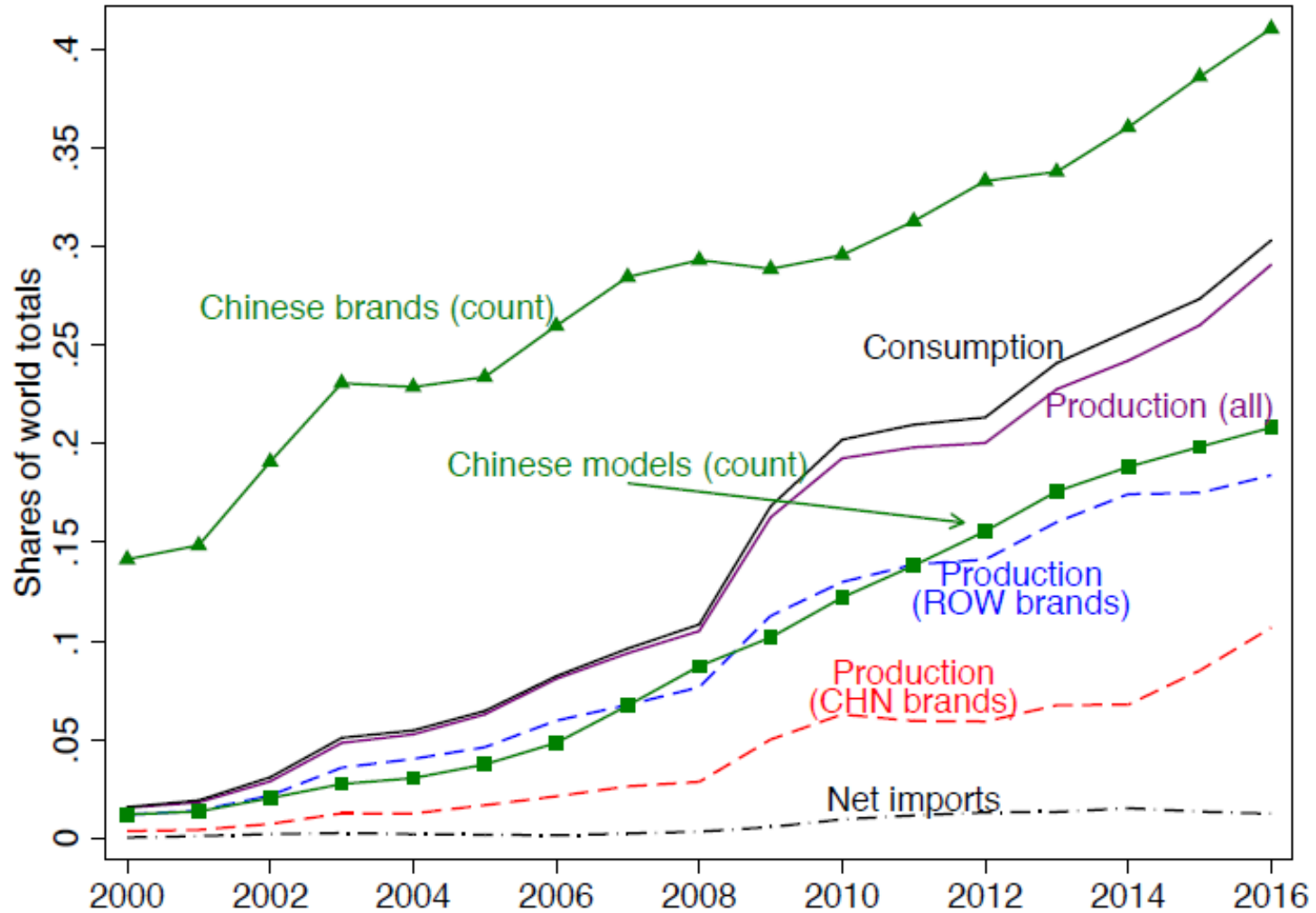
Source: Mayer and Head (2018)

Research Questions:
on the automotive supply chain in Mexico

Two main issues

- the impact of the **new trade agreement** with US and Canada:
    - its effects inside the country
    - and its cross-country impact on the automotive global value chain;
- The impact of the **digital technological transformation**

A conceptual framework_system transformation

- cross industry transformation and competence networks within Mexico
- cross country trade and plant locations within Mexico

Methodology (design)

- abductive reasoning
- desk analysis of the supply chains and trade agreements
- data from secondary sources
    - on plant location, specializations, domestic production/export/import
    - costs (labour, input, transport)
- data from interviews with suppliers, with experts and with business associations of the automotive industry [transcriptions & rich points]
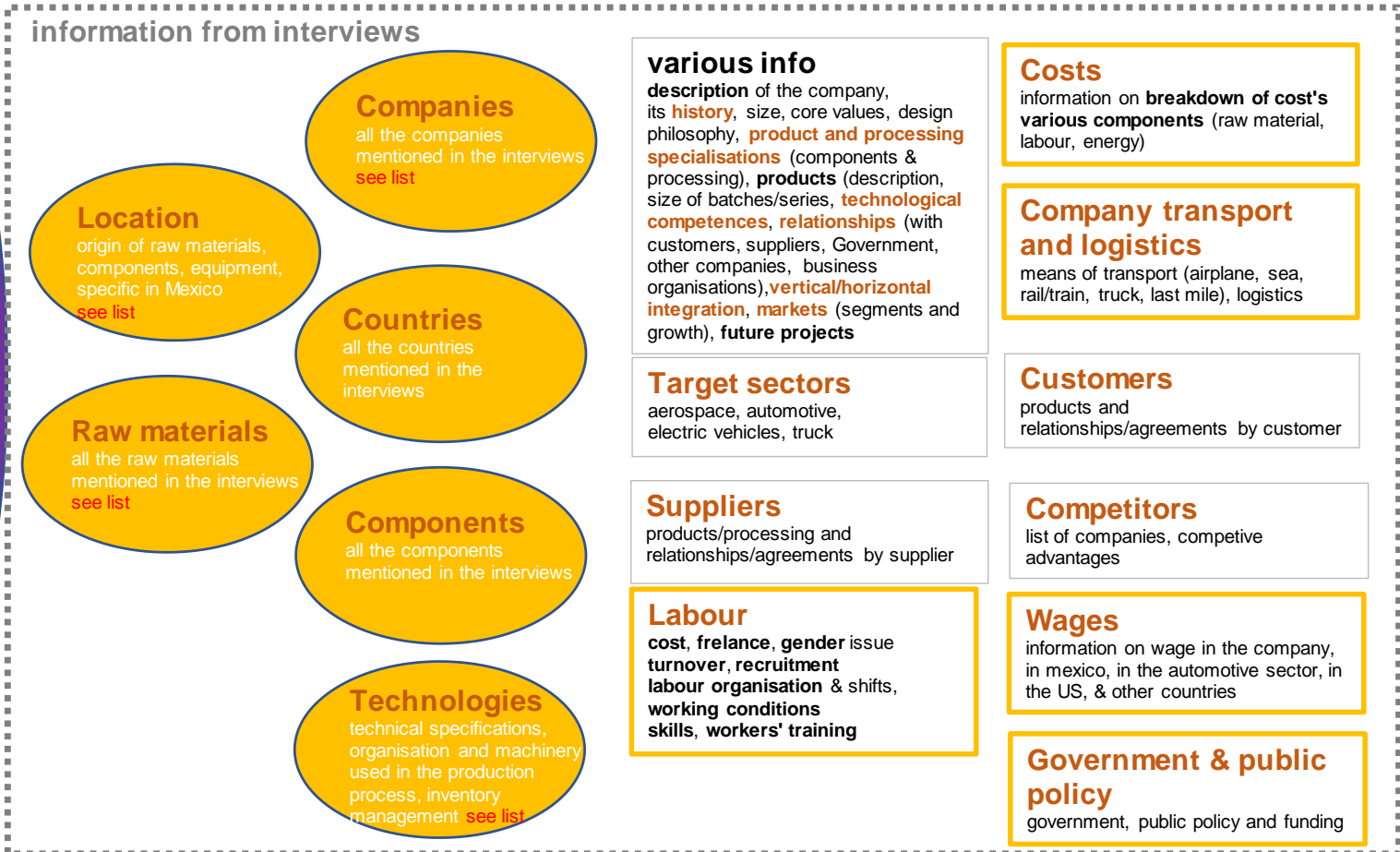
Data sources_interviews & topics

Interviews/meetings

– with **10 experts** [3 business associations], 2 **academic researchers** and

– with **11 managers** in the purchasing, production, R&D, human resources, logistics functions at OEM Tier 1 and Tier 2 suppliers

- Queretaro (Eurotranciatura_4, Rassini_5, MTA_1), Mexico City (Peasa_1)
- 1 SME and 3 medium size companies,
- all companies belong to groups (2 Mexican, 2 Italian)
- Main products: rubber parts, exhausting systems, electric engine components, fuses
- Main processes: die casting, cold forging, metal stamping, pressing, assembling

Open questions interviews:

→ position in the supply chain (tier 1, 2…), customers and suppliers, OEM
→ present specialization: what they produce (type and quantity), how they produce (technologies and organisation),
→ n. of employees, labour competences and skill
→ present and planned adoption of I4.0
→ expected changes due to the trade agreement (with respect to relationships with supplier and customers, and to internal organization)

Key information and issues

Literature review digital transformation, automotive supply chain, trade flows & trade agreements, wage structure in Mexico and the US, public policies in Mexico

Companies
all the companies mentioned in the interviews
see list

Location
origin of raw materials, components, equipment, specific in Mexico
see list

Countries
all the countries mentioned in the interviews

Raw materials
all the raw materials mentioned in the interviews
see list

Components
all the components mentioned in the interviews

Technologies
technical specifications, organisation and machinery used in the production process, inventory management see list

various info
description of the company, its **history**, size, core values, design philosophy, **product and processing specialisations** (components & processing), **products** (description, size of batches/series, **technological competences**, **relationships** (with customers, suppliers, Government, other companies, business organisations),**vertical/horizontal integration**, **markets** (segments and growth), **future projects**

Target sectors
aerospace, automotive, electric vehicles, truck

Suppliers
products/processing and relationships/agreements by supplier

Labour
cost, **frelance**, **gender** issue **turnover**, **recruitment** **labour organisation** & shifts, **working conditions** **skills**, **workers' training**

Costs
information on **breakdown of cost's various components** (raw material, labour, energy)

Company transport and logistics
means of transport (airplane, sea, rail/train, truck, last mile), logistics

Customers
products and relationships/agreements by customer

Competitors
list of companies, competive advantages

Wages
information on wage in the company, in mexico, in the automotive sector, in the US, & other countries

Government & public policy
government, public policy and funding

other TOPICS

IoT   Data analytics   Innovation, Investment, R&D

Labour   Location   Costs, wage, price   Co-design   Competitors   Cultural factors

Economic long wave   Entry barriers   Italy vs. Mexico   Labour_gender issue

Product_import content   Use/ownership of technologies   Traceability, Inventory management

Trade agreements (NAFTA, T-MEC/USMCA, TPP)

Main findings_trade agreement

1_Impact of the new trade agreement with US and Canada

Feedback from interviews show **positive expectations** of the impact of the new agreement on the Mexican automotive industry, though the **ultimate assessment** will depend on the final decisions to be made with respect to the four rules to be fulfilled in the USMCA/T-MEC: the share of regional value content (RVC), the share of purchases of steel and aluminium in the region, the minimum per hour wage, the RVC of the core auto parts.
An instance of positive expectations: the recent opening of a new plant of BMW in San Luis Potosi

2_Regional content: effects inside the country and cross-country impact on the global value chain

While two of the rules (those requiring a minimum regional content) are likely to benefit Mexico, the overall effect will depend on the definition of the penalties for non-compliance and on the strategies of the OEMs relative to their suppliers' present location.

Main findings_working place & plant location

3_Working environment and working conditions

Compared to the standards of similar Italian companies, perhaps the requirements for air quality in the shop floor were less stringent (although they have the environmental certification Iso14001). It is the **rhythms of workday**, without breaks (4 hours plus another 4 after a lunch break of one hour) that **make the difference**.

4_Cross country trade and plant locations

Both Mexican and foreign **companies are expanding their productive capacity in Mexico**.

In case of reduction – as for Nissan – it is due to a reorganization needed to cope with changes in the upsurge in the US demand for different cars.
The location of new plants is driven by the incentives offered by the states, which attract plants with high value added technologies/products: a powerful development policy of which we will further investigate the characteristics and extent of the incentives, by state.

Main findings_Digital Transformation_1/3

5_Cross industry transformation and competence networks

The digital transformation is already producing several changes: the **emergence of new actors and competences** (among others, software designers for data collection and data analytics) both within and outside the firms, cross industry transformations (with impacts on automotive, aerospace, truck and buses). Relevant competence networks range **within the country, across the region** (US, Canada) **and the global value chains** (e.g. Japan, China, Italy).

6_Between digital and manual: the digital representation of the production process_*digital twin*

In the companies interviewed, the focus of the digital transformation concerns the **digital representation of the production process**.

Their production process is **automated**, but the machines are fed and unloaded mainly **manually**. The movement of loads (beyond the limits set by the standards) is assisted by bridge cranes or pneumatic devices.

The repetitive work on board the machine may not be exhausting, but it is continuous (the only breaks are for lunch).

Digital technology consists of **digital controls of the operation of individual machines** (forging, stamping, etc.). It allows suppliers to be aligned with the customers' needs (tiers 1 and OEMs): in **keeping track of the production, and in the optimisation and control of the production process, but also of the workers**.

Main findings_Digital Transformation_3/3

7_Software skills

The development of software applications for data collection, transmission and processing is based on **a constellation of specific applications**, some developed ad hoc **by freelance consultants, other purchased from digital start-ups**. The overall home-made design did not seem different from what we found in companies that make use of **Siemens platform**.

8_Digital transformation: a marketing issue

Digital technologies are considered necessary, especially for those suppliers in the automotive value chain that are moving towards the **aerospace** industry.

9_Automation and manual work

The **automation** of the moulding and forming phases (with high power, capacity and precision plants) is **flanked by manual operations** to unload the machined pieces, but also to fix welding nuts.

The welding of pipes and sub-assemblies (mufflers, for example) is still a **highly professional operation, carried out by hand, due to the small size of the batches produced**.

Relative small size of batches and relative low volume of production still find in manual tasks a source of flexibility to reduce average costs.

Policy implications

In the overall design shaping the global value chain in the automotive industry, there are **opportunities for the OEMs to keep important segments of their value chains in Mexico**

Policy indications for the Federal and the State governments in Mexico.

→ **Industrial and training policies and policies for retaining workforce**

The new government is **not only** asked for **system policies** (transport infrastructure, for example, or the fight against corruption, on which this government has embarked).

The managers point out **a detailed list of industrial, research and training policies** to accelerate the pace of change, with a focus on **young people as carriers of new knowledge**.

vs. the current policies: national and state (regional)

Financing research institutes, regional training centres (CONACYT).

Subsidies/incentives to high-tech investment poles

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