The automotive sector in Mexico.
The impact of automation and digitalization on employment

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Automation and Employment in the Apparel and Automotive sectors in Mexico

ILO, Webinar, May 23, 2023


International Labour Organization

European Commission

Research paper n° 15

April 2023

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Objective

To understand how automation and digitization processes are implemented in the Automotive Industry in Mexico

To understand how this affects employment and work organization in the Automotive Inudstry in Mexico

https://www.ilo.org/employment/Whatwedo/Projects/building-partnerships-on-the-future-of-work/WCMS_877324/lang--en/index.htm

Methodology

- Two plants were selected: Ford Hermosillo (1986) and Toyota Guanajuato (2019)
- Relevance: Both plants (American and Japanese) are highly competitve and they produced unique models for the entire world.
- Presents first-hand information, recent and authorized by companies, on automation and digitization processes (an exemptional case)
- Methodology:
  - First phase: economic, technological and employment data were obtained (secondary data, interviews and guided tours of the plants). December 2021
  - Second phase: visits to the plants and 22 semi-structured interviews with managers, engineers, workers and trade unionists August-November 2022.

Debate

- Unemployment & deskilling. Vs. job reskilling and the hiring of people with different skills. (Autor et al., 2020; Anzolin, 2021, Krzywdzinski, 2021).
  - Automation has been characterized as an evolutionary process (Brynjolfsson y McAfee, 2014; Harteis, 2018; Arslan et al., 2021).
  - Digitalization and technologies associated with I4.0 are transforming it in a substantive way, for example, with the adoption of collaborative robots or artificial intelligence (Anzolin 2021).
- Automotive industry: pioneer in the introduction of automation / the largest stock of robots in manufacturing (1 million or one third of the total) (IFR) / often touted as the cutting edge of automation / consume & produce this type of technology.
- Automation & digitalization of production processes have shaped the automotive industry for several decades (Butollo et al, 2022; Krzywdzinski, 2021; Pardi et al., 2020).
- Has shaped production models emulated in other industries globally :
  - Fordism, Lean Production, I4.0 (thanks to Ford, Toyota, and German companies, respectively) (Boyer y Freysenet, 2003).
- “Experts do not see any increase in OEM & suppliers EV employment, but they are uncertain about how much of a decrease will occur” (Belzowski, 2023)

Findings. General characteristics (2022)

Characteristics	Ford Hermosillo	Toyota Guanajuato
Start operations	1986 (36 years)	2019 (3 years)
Location inside Mexico	Hermosillo (North West)	Guanajuato (Central)
Production	252,000	138,000
Segment	SUVs	Pick Ups
Models	Bronco & Maverick (world producer)	Tacoma (world producer)
Export ratio (mostly North America)	98%	97%
Employment volume	3,400	2,252
Union	CTM (cooperative union type)	CTM (cooperative union type)
Automation level	High	Medium-high
Outsourcing employment (in-house)	2,604	2,500

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Findings. Description of technology

Area		Ford Hermosillo (HSAP)	Toyota Guanajuato (TMMGT)
Stamping	High automation	High speed & more versatile press line 22 robots. 190 workers perform tasks of classification, inspection, and placement of parts in racks and deliver	12 robots Concentrates about 8 per cent of the robot 12.5 employees for each robot
Bodywork	High automation	New-generation 757 robots execute 100 per cent of welding points (2,800) and cameras with vision systems detect errors in the process; 680 employees	58 robots, 1 robot for training, 4 AGVs, and an automatic transporter Concentrates about 54 per cent of the robot
Painting	High automation	High level of automation, 155 robots; 400 workers applying body seam seals or wallpapering for two-color options, and quality inspection. This area is free of residual water.	Highly automated Concentrates about 35 per cent of the robot 8.5 employees for each robot
Final assembly	Mostly manual	7 robots to handle large or heavy parts. Screens have replaced paper. Robots and employees work together. 1,300 workers. This process is more dependent on digitalization	Mostly manual, but with pneumatic stations, and few robots. 243 employees for each robot
Quality control	Mostly manual	2 robots. Internal test track, quality inspection, and road test. 200 workers. All data are collected onto a computer system to verify electronic parts.	Mostly manual, but with pneumatic stations, and few robots.
Logistics	High digitalization	Computer systems are used to track logistics inside and outside the plant JIT relies on electronic orders to extract parts from storage. The design of routes to supply parts to assembly lines is supported by CAD systems.	Develop digitization projects, ex.. drone inspection system on trailers that scan sensors with RFID.

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Example of I4.0 projects. TMMGT and University of Queretaro collaboration

AVS (Automated Vision System)[1] robot for weld burr detection.

Burrs generated in the welding process cause quality and safety problems. Team members used to visually detect and make repairs manually.

Software for fault trend detection.

Equipment failures have negative impacts on production as they imply overtime work to correct mistakes. The manual and visual system has been replaced by integrated software to obtain information, including sensors which send alerts, predicting losses and failures, and providing solutions.

AVS robots for error detection in confined spaces.

Line production with little accessibility is difficult to monitor. The manual and visual system has been replaced by AGV 'rovers' (with vision system and artificial intelligence) which can access and detect possible faults.

[1] The Toyota's AVS is known in the literature as AGV (Automated Guide Vehicles).

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Interviews Results

Drivers of automation & digitalization

HSAP & TMMGT are broadly driven by three central motives

(a) Economic, focused on productivity, efficiency, consistency, quality, and flow;
(b) Social, focused on occupational safety and health, and
(c) Environmental, focused on water consumption

Challenges to automation

Three challenges were highlighted

(a) Loss of staff
(b) Financial resources
(c) Culture

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023.

Work organization, occupation composition, and wage structure

	HSAP	TMMGT
Organizational Structure	Lean TPS	Lean FPS
Wage Structure	15 levels	9 levels
Hourly Pay, Average (does not include economic & non economic benefits)	$2.6 US dlls	$2.4. US dlls
Occupational Structure	Flat 10 areas	Flat 17 areas
Occup. Composition	%	%
Stamping	7.0	5.6
Welding (Bodywork)	21.2	17.8
Paint	12.4	16.9
Final Assembly	44.6	32.6
Quality control	5.4	13.1
Others	9.4	13.9
Gender inclusion	18% women	27% women
Unionized Employees	88%	73%

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Impacts on employment

The introduction of automation and digitalization in both plants has generally not led to worker displacement, but rather has been observed:

- Training process, recycling and/or continuous training and skills development
- Strengthening internal mobility and job rotation
- Increased participation of women

(Changes, in terms of more shifts, pace of work due to the speed robots, or less worker autonomy, are related with expansion capacity).

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023.

Perceptions about automation

- In general, the introduction of new technologies is perceived positively for all employees.

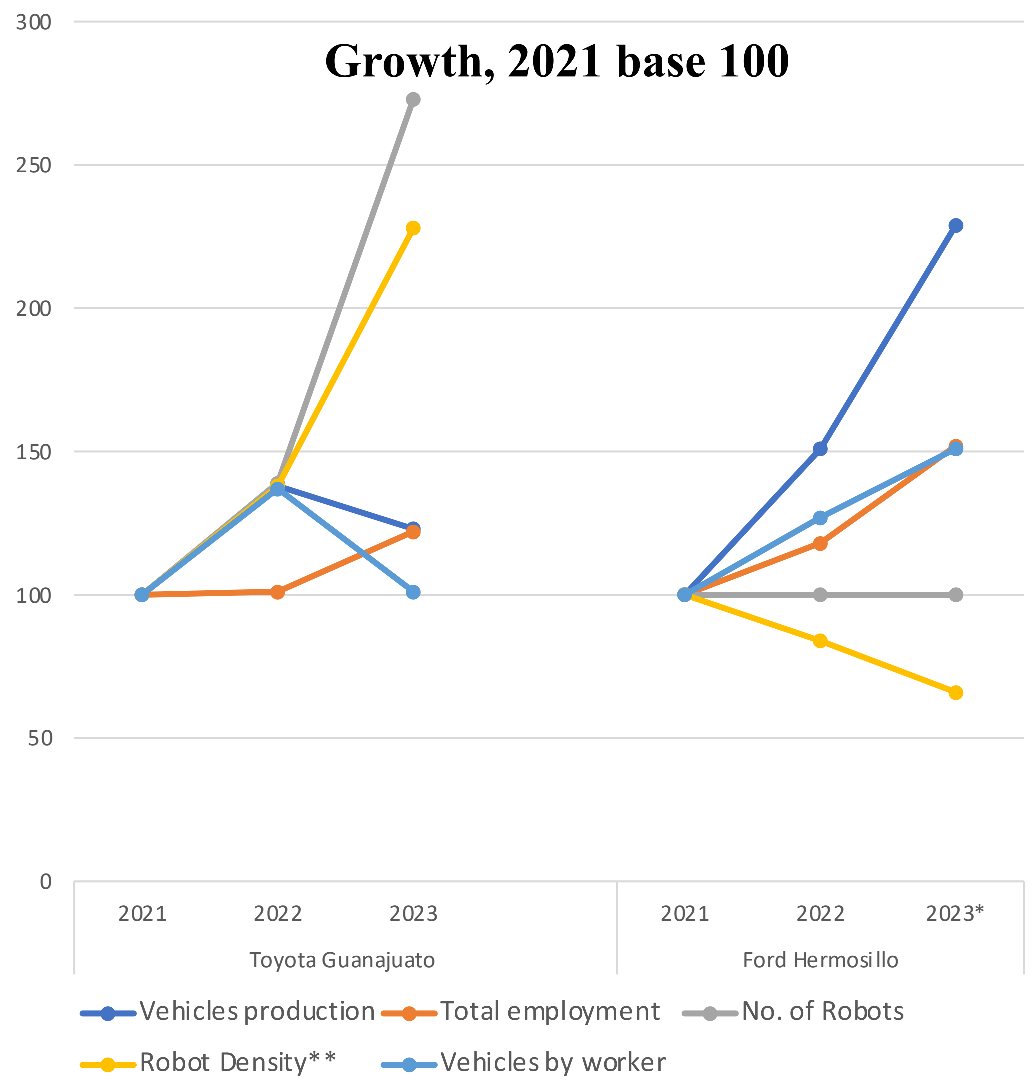
+	−
❖ Increase and maintain production rates ❖ Eliminates and/or reduces work risks ❖ Quality and continuous improvement ❖ Efficiency and sustainability	❖ The risk of losing skills or autonomy

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023.

Two different paths?

Company	Year	Vehicle production	Total employment	No. of Robots
Toyota Guanajuato	2021	100 000	2 233	127
	2022	138 000	2 252	176
	2023	123 000	2 717	347
Ford Hermosillo	2021	167 000	2 870	941
	2022	252 000	3 400	941
	2023*	383 000	4 370	941

Note: * forecast.

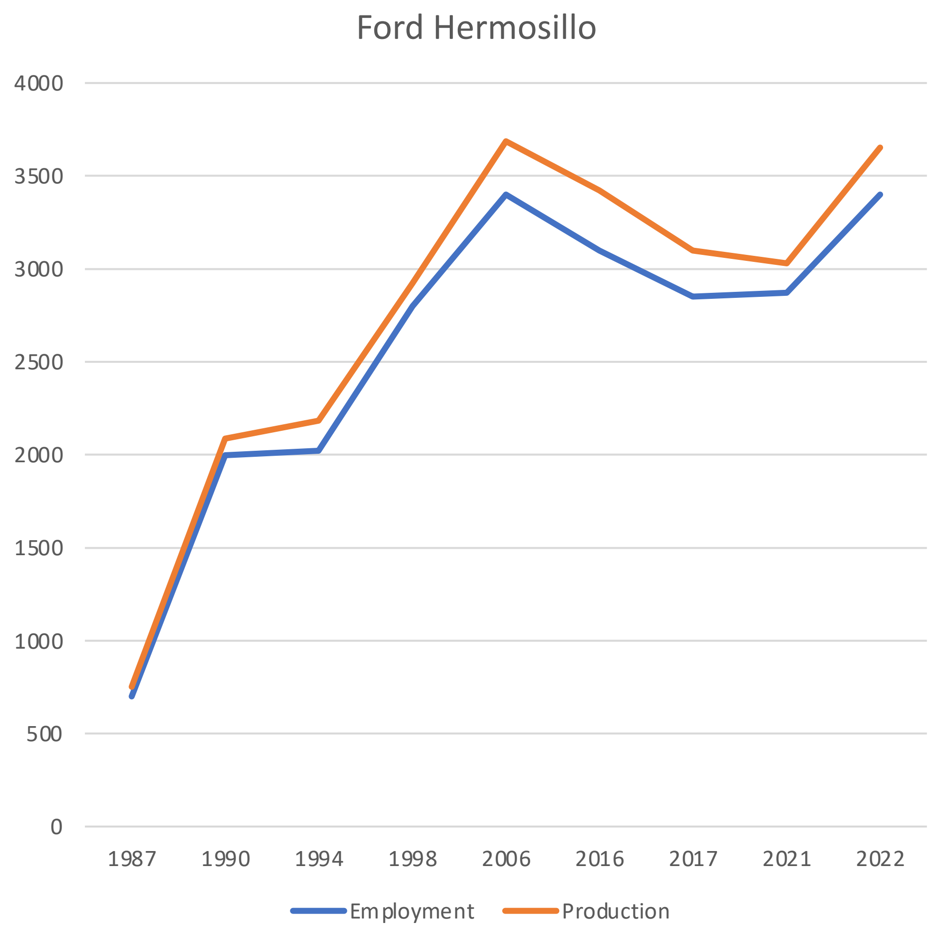


Robot density in manufacture 2021: 141 robots by 10,000 employees (IFR)

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Example of Platform change. Ford Hermosillo

Platform	CX3	CD	CD4	CX430, P758
Models	Focus ZX3	Fusion, Milan, Zephyr	Fusion, MKZ	Bronco, Maverick
Period (introduction and end)	1987-2004	2005-2011	2011-2020	2020-
Production Rate (Units per hour)	23 to 45	Up to 63	Up to 63	Will increase up to 73
Changes in Automation	Automated stamping presses, first robots in bodywork; heavy tools	Increasing number of robots in stamping, body and painting. Some robots in final assembly and electric tools	Increasing and upgrading robots in stamping, body and painting. More robots in final assembly. Upgrading electric tools	New generation of robots in body and painting. New generation of stamping presses. Wireless electric tools



Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023. Based on company information

Main Conclusions

- Platform (model) changes were key
- Automation and digitalization did not imply unemployment
- It involved relocation of several of the affected workers and general retraining
- Automation and digitalization increased, employment increased and production grew

- *Sine qua non* condition: growing demand to have a “virtuous circle”
- Is a simple HQ decision? No, plants compete and work for it. Competitive and innovation strategy at the subsidiary level (relative autonomy)
- Two plants, two trajectories. Country of origin or MNE strategy matters

Source: Carrillo, Martinez, Lopez y Diaz Muro, 2023.

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Acknowledgments

The authors wish to thank the companies for their valuable support without which this research would not have been possible. Special thanks is extended to Francisco García, President of Toyota Guanajuato who was extremely open to the research project throughout the process. Also we want to thank Alejandro Coronado, Risk Manager at Ford Hermosillo for all his support.

Thank you

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