Institute for Innovation and Public Purpose

Digitalisation and automation across business models and work-organisational effects

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Outline

- Background

- Process automation and digital production technologies
- Drivers of automation in automotive: structural and economic
- Technology choice, organizational integration and business models
- Case study South Africa: OEMs
- Work organizational effects: some reflections

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Background

- Robotising Regions: National and Province-based Industrial Policy for Robotisation in China (co-authors: Federico Frattini and Giorgio Prodi), in preparation for ***New Political Economy***
- What is driving robotisation in the automotive value chain? Empirical evidence on the role of FDIs and domestic capabilities in technology adoption (co-authors: Guendalina Anzolin and Antonello Zanfei), ***Technovation***, RR.
- Digitalization, industrialization, and skills development: opportunities and challenges for middle-income countries (co-authors: Justin Barnes, Anthony Black, Timothy Sturgeon) in: Andreoni et al. (eds.) ***Structural Transformation in South Africa: The challenges of inclusive industrial development in a middle-income country***, Oxford: Oxford University Press, 2021.
- Natura non facit saltus: Challenges and opportunities for digital industrialisation across developing countries (co-authors: Ha-Joon Chang and Mateus Labrunie), ***European Journal of Development Research***, 2021, vol. 33, 330-370.
- Robot adoption and FDI driven transformation in the automotive industry (co-authors: Guendalina Anzolin and Antonello Zanfei), ***International Journal of Automotive Technology and Management***, 2020, vol. 20, no. 2, 215-237
- A revolution in the making? Challenges and opportunities of digital production technologies for developing countries (co-author: Guendalina Anzolin), ***UNIDO Working paper series***, 2019.

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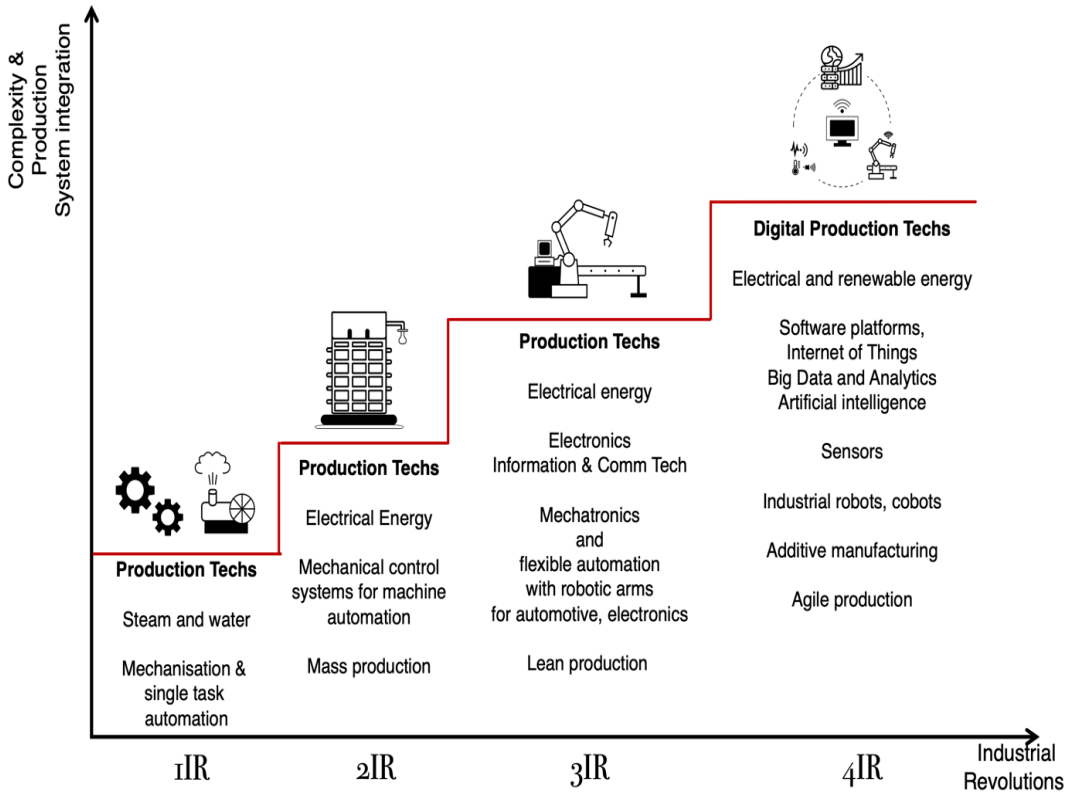
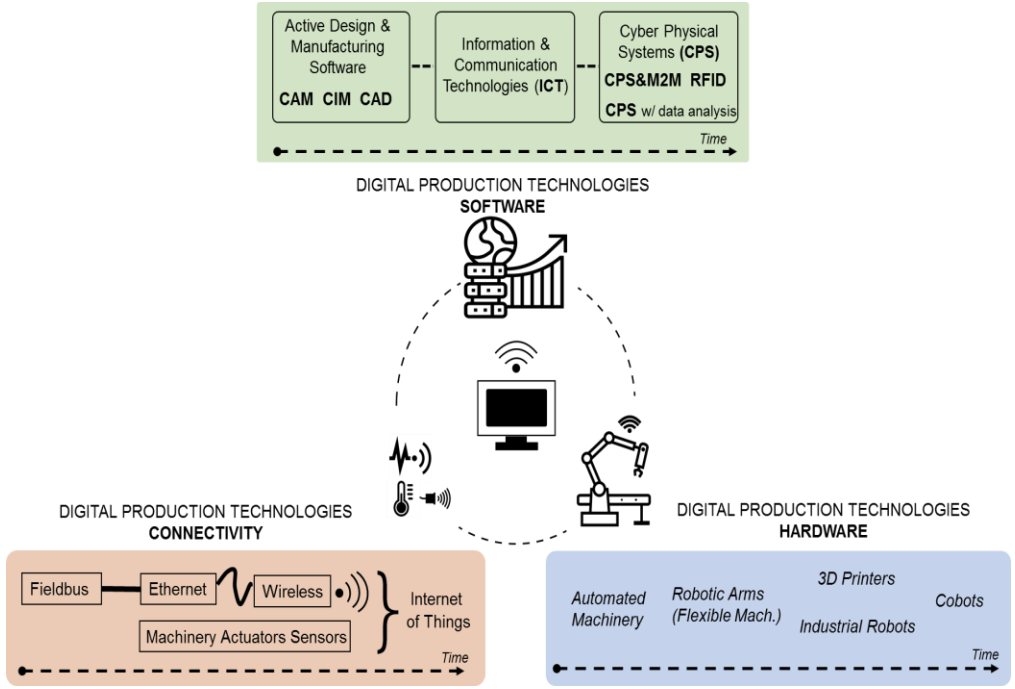
Process automation and digital production technologies

- **What *kind of* automation?**





- **What degree of digital maturity?**

From a case study on Spain (low diffusion of 4IR technologies)

Industry 4.0 technology	Timing	
Integration of the production process with ERP system	Since 2016. Still in progress	Process control and stability; real-time information; predictive maintenance; 100% traceability = no paperwork
Automation (cobots)	Since 2017. Few examples	
AGVs	Since 2017. Fast development	Being rented. Adoption easy to justify (cost/benefit)
Inventory control and automation	Since 2017. Still in progress	
3D printing	Initially in 2012; most adopters since 2019	Limited use (no production): prototypes, tools, etc.
Virtual reality	Only in R&D	Training
Augmented reality	Only in R&D	
Artificial intelligence	Since 2018	Only for very specific problems
Data analysis systems	To be developed	

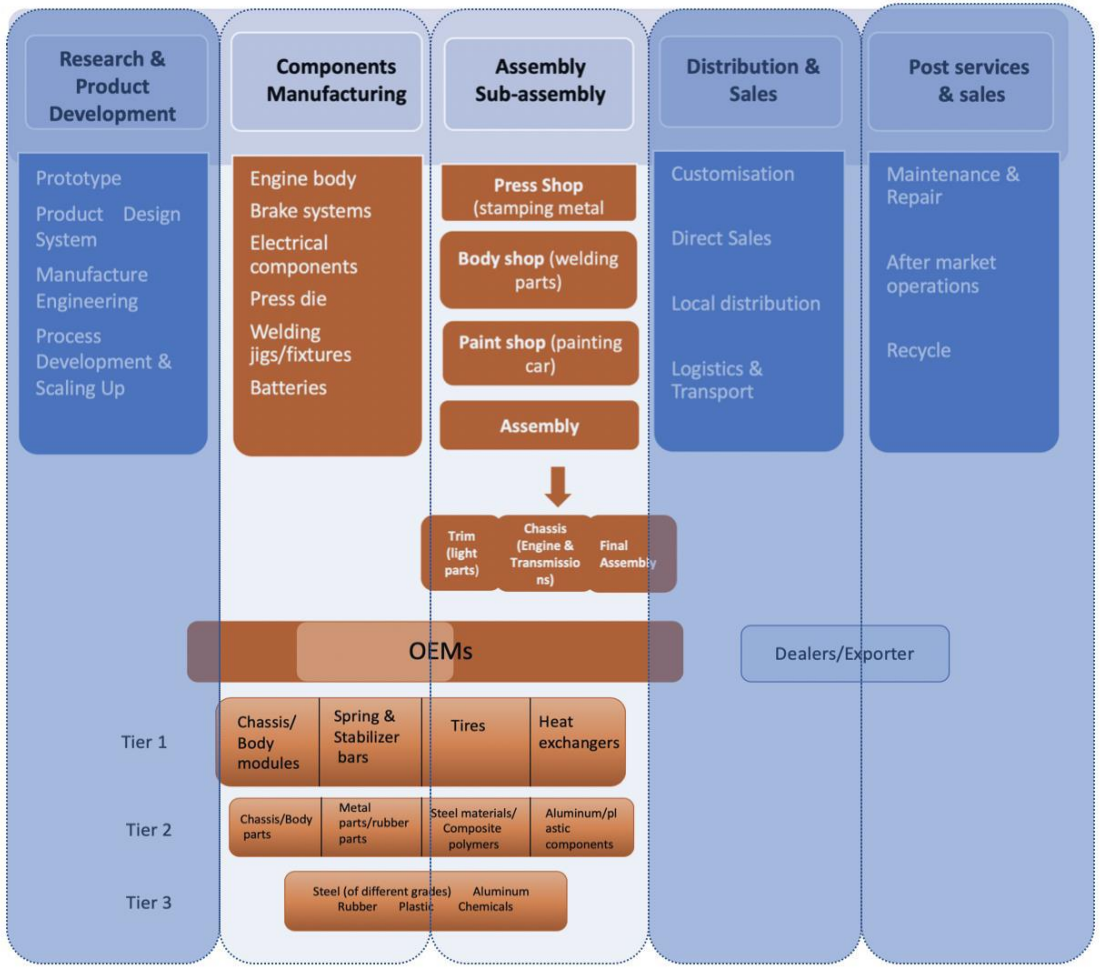
Alaez-Aller et al., 2020 chapter 4.

Process automation and digital production technologies

- What kind of automation to expect ***where?***
- What **degrees of heterogeneity**?

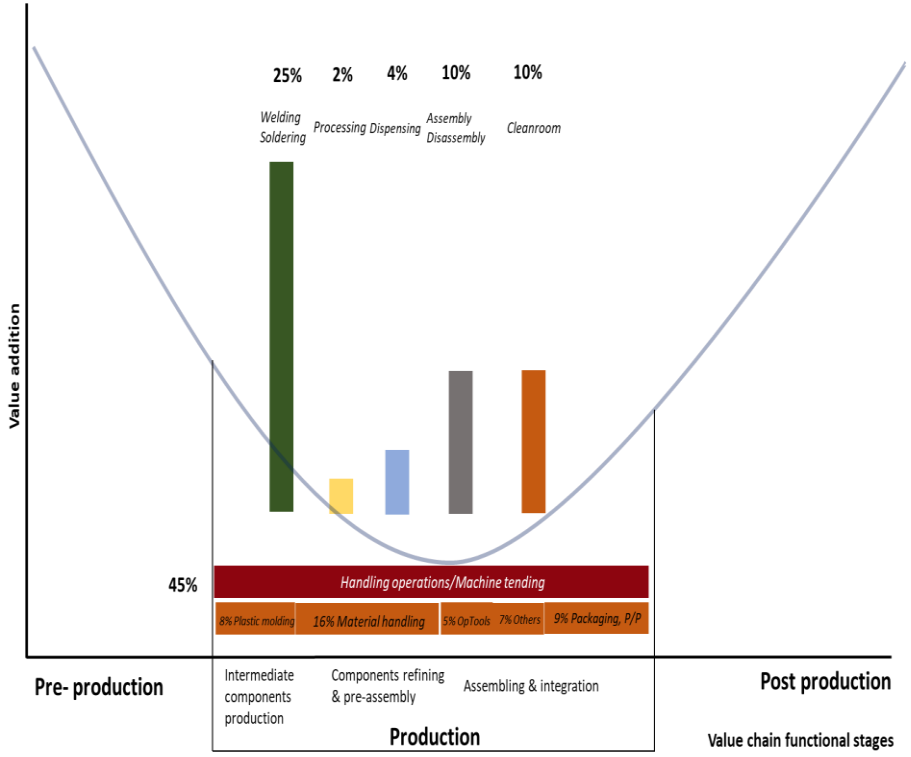
- **Stages of the automotive value chain and countries (EU – non-EU)**

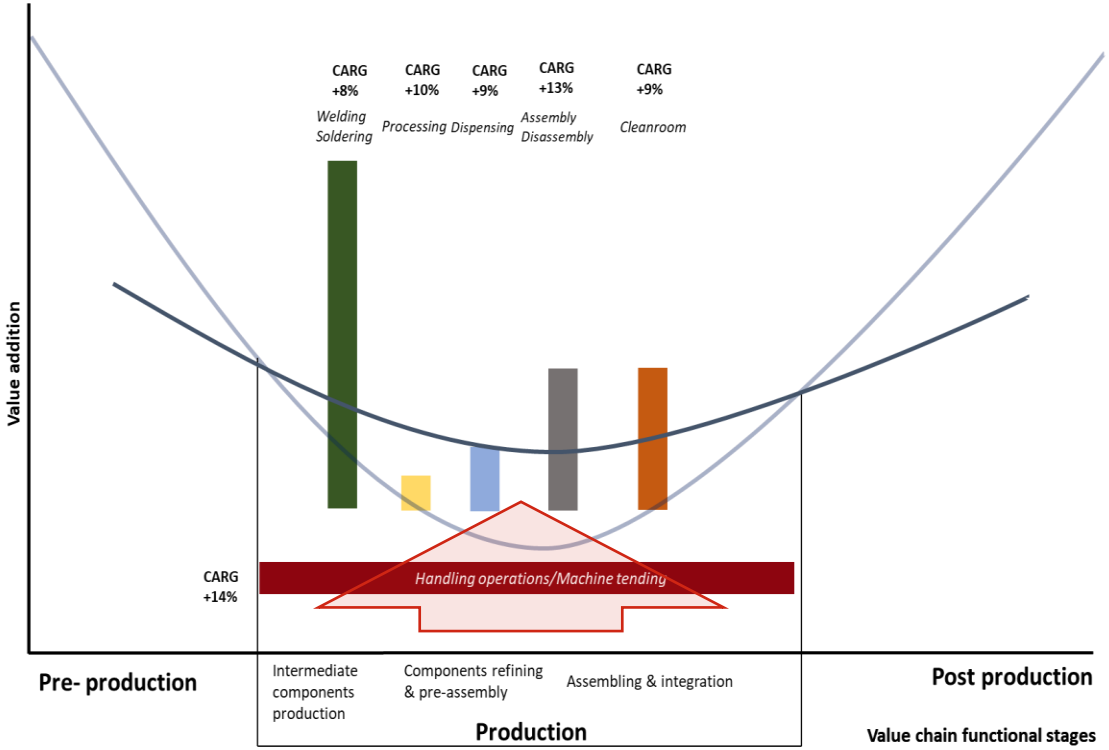
- **OEMs**:
  - Lower heterogeneity across “sister OEMs/benchmark plants” within same automotive companies and higher comparability (e.g. Toyota)
  - Higher heterogeneity for different product/market segments (different skills, cost structures)
- **Tier 1 (including co-located extended OEM plants)**:
  - Cascade effect depending on component-OEMs match and business models (e.g. Valeo)
- **Tier 2-3**:
  - high heterogeneity across countries given different digital capabilities and skills



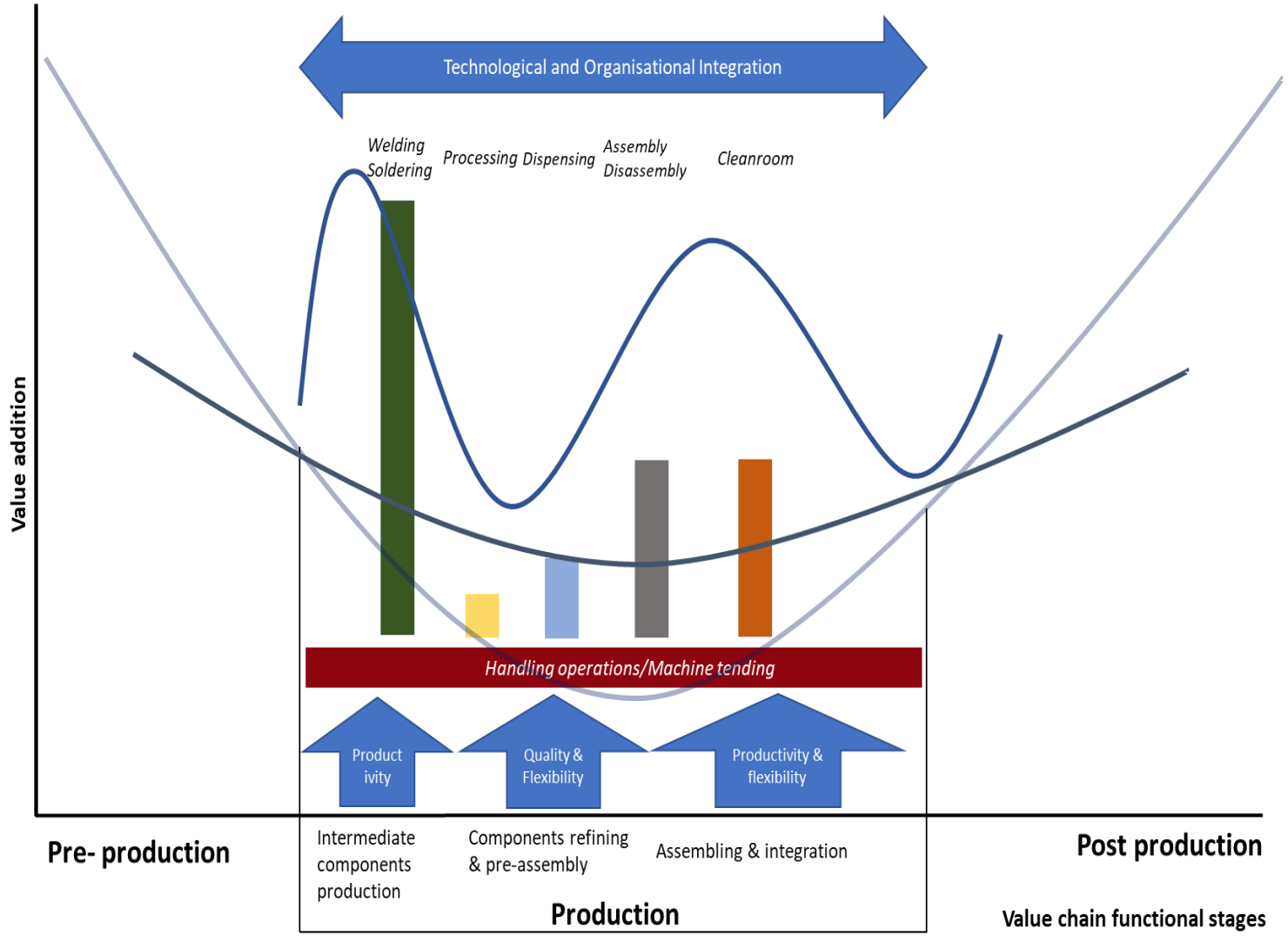
Process automation and digital production technologies

- **What *kind of functional-tasks* automation?**

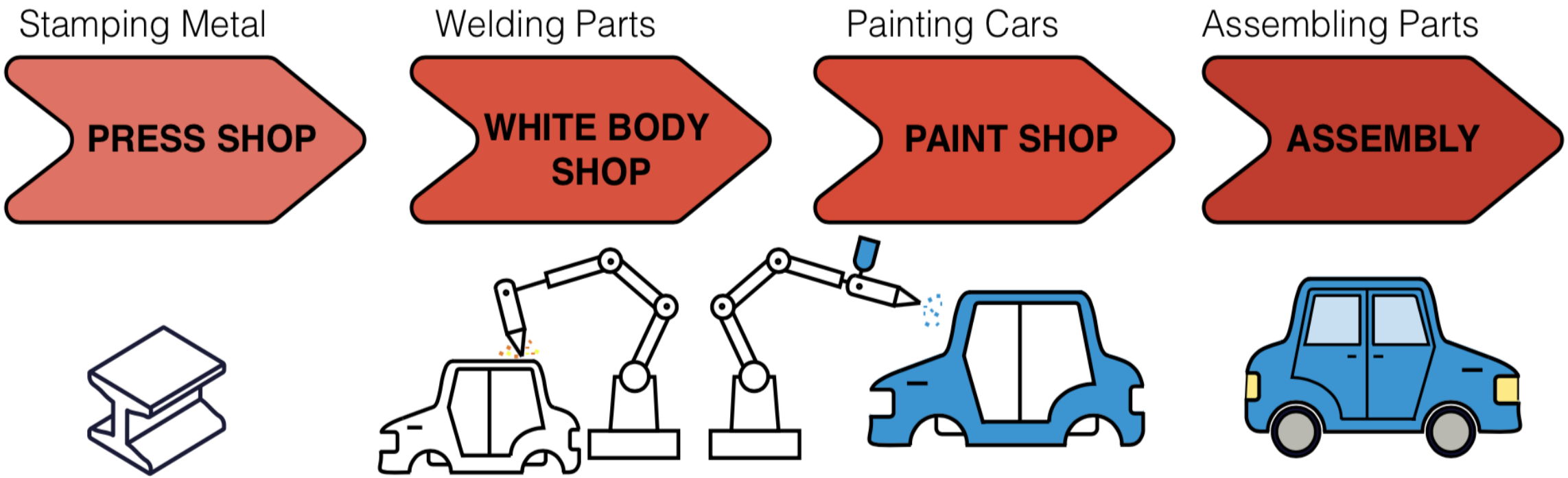




Drivers of automation: opening the black-box



Drivers of automation in automotive



Structural and economic drivers of automation

Structural (feasibility)

- Product design specifications (including life cycle)
- Product quality (and customisation)
- Production modularisation (within OEMs and along Tiers-VCs)
- Tasks interdependencies in tech automation within continuous processes
- Process ergonomics and safety

Economic (opportunity)

- Productivity vis a vis CAPEX
- Production volumes and quantity (including market access)
- Costs of automation (robots / cells, robots-line integration/retrofitting)

Structural and economic drivers of automation: technology choices and organisational integration

Structural (feasibility)

Product design specifications (including life cycle)

Product quality (and customisation)

Production modularisation

Tasks interdependencies in tech automation within continuous processes

Process ergonomics and safety

Economic (opportunity)

Productivity vis a vis CAPEX

Production volumes and quantity (including market access)

Costs of automation (robots / cells, robots-line integration/retrofitting)

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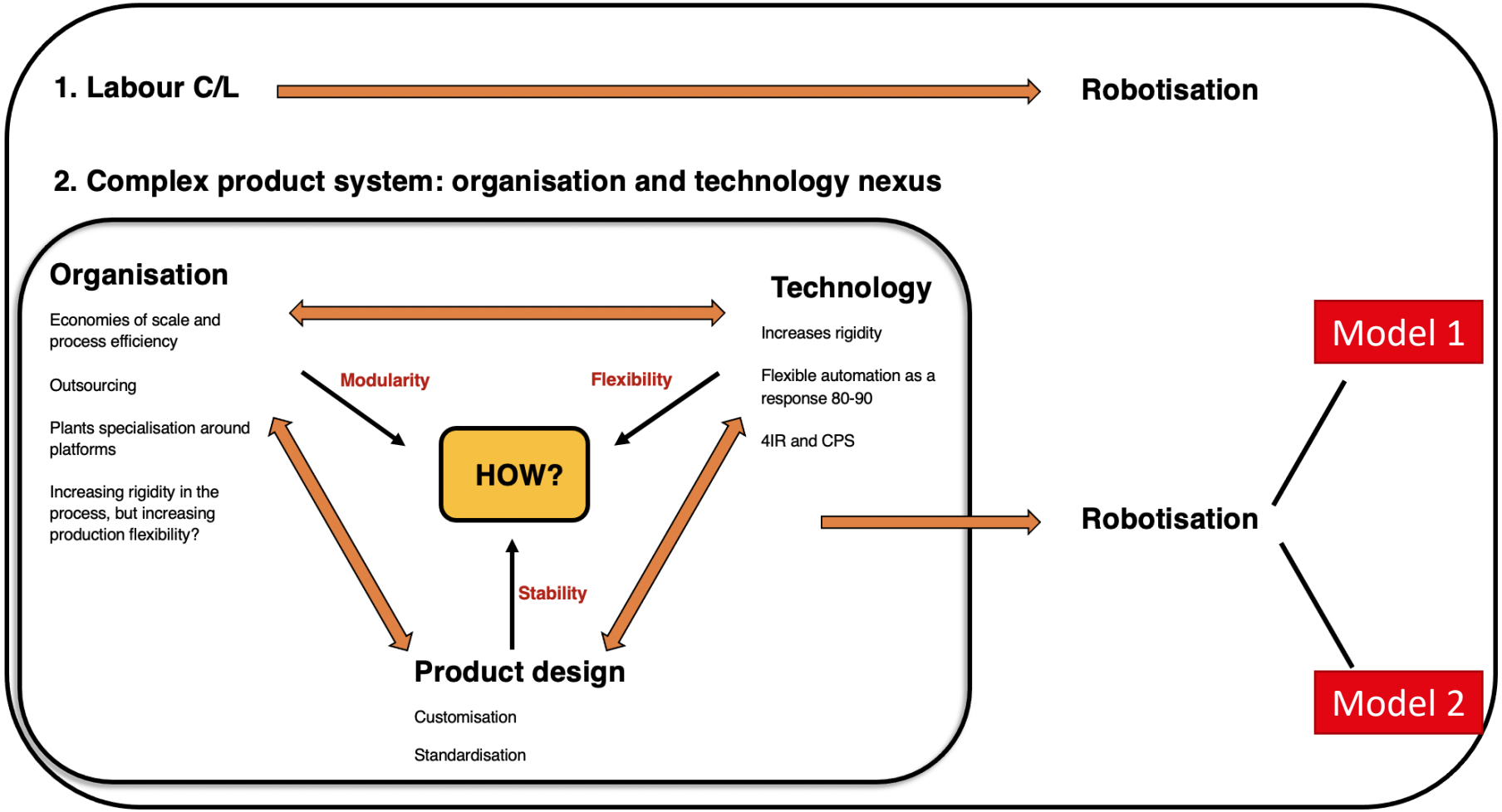
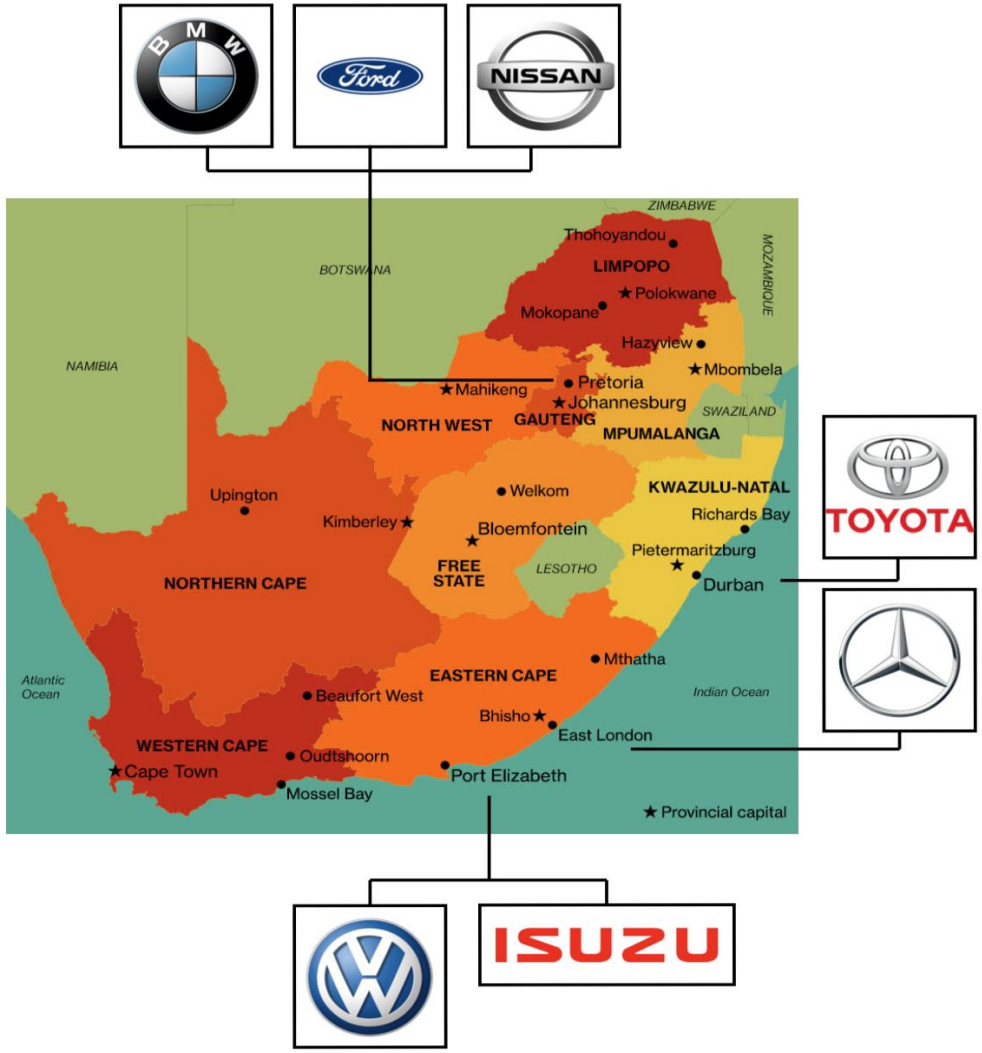
Technology choice, organizational integration and business models



Case study: OEMs in South Africa



Company	Model/s produced	Number of vehicles produced	Main technologies object of the interview	Specific area of plant visit	N. of people interviewed	Employees
BMW	3 Series and X3 (launched in 2018)	76,000	Industrial robots	Body shop	Two	3,500
Ford	Ranger, Everest	168,000 (ca.)	Industrial robots	Body shop, Final assembly	One	3,700
Isuzu	Isuzu KB and D-Max	n\a	Industrial robots	n/a	Two	130
Nissan	NP200, NP300 Hardbody	32,836	Industrial robots	Body shop	Two	2,501
Toyota	Hilux, Quantum, Corolla 4 doors (and previous models) and Fortuner	242,000	Industrial robots	Body shop	Three	8,539
VW	Polo new and previous series (designated Vivo)	200,000	Industrial robots, virtual reality, 3DP.	Press shop, Body shop, Paint shop, final assembly	Four	4,167

Case study: OEMs in South Africa

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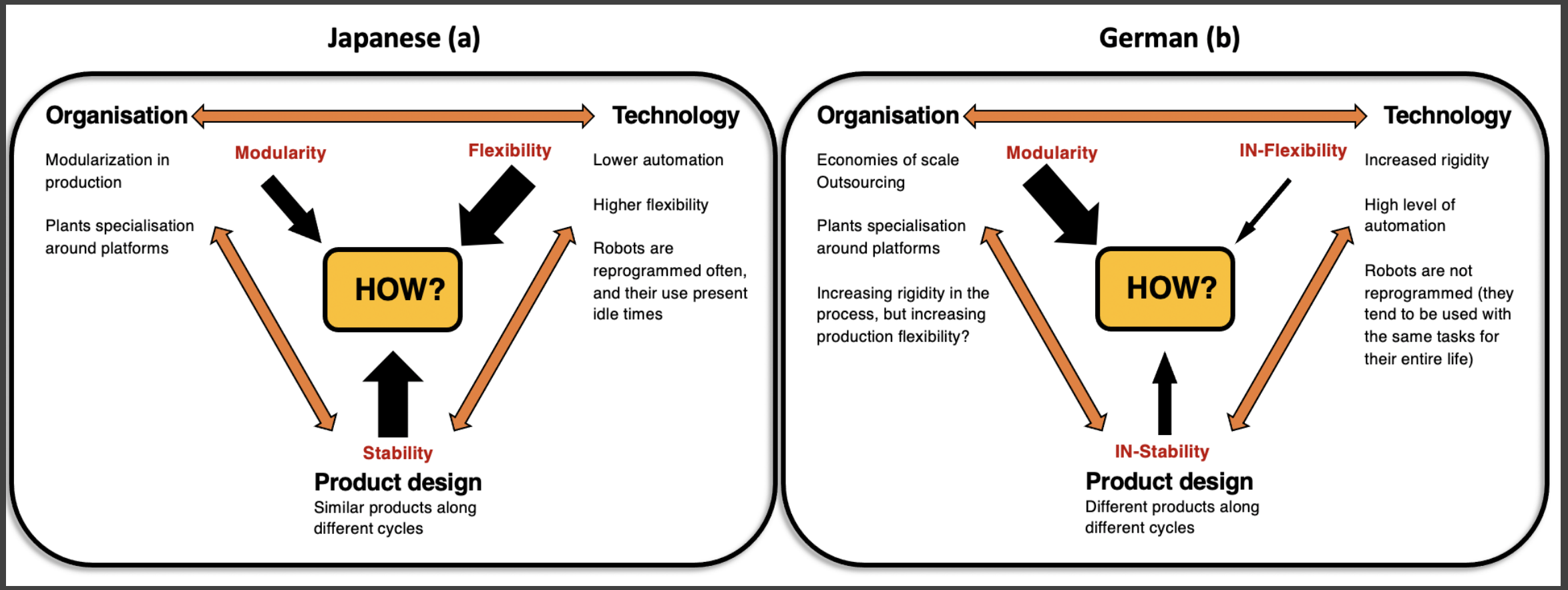
The how? Different Business Models



Differences and potential effects on workers skills profiles

Japanese automotive model

- Cost reduction and robust process
- Product Flexibility (across cycles)
- Process Flexibility (easy retrofitting and conversions)
- More heterogeneity in automation (only when it makes sense)

More workers in assembly?

Continuous and more cross-functional training ?

German automotive model

- Product quality/spec driver
- High modularity
- High automation (and linked to product cycle 24H/7Y)

Less workers in assembly?

Highly specialised training?

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Work organisational effects: some reflections

- The *how* of robotisation affects:
  - **Speed and depth** of automation / robotisation / digitalisation
  - Potential **displacement** (robots substituting or complementing – e.g. co-bots)
  - **Disproportional impact** of displacement across tasks and types of workers
    - Gender effect given the different distribution of M/F workers along the production line/tasks distribution
  - Disproportional impact on individual **skills profiles and need for training / re-training** (depending on degree of skills transferability)
  - Impact on **organisational models / collective-team skills / changes in supervisory and team coordination roles**
  - Potential positive **gender pull** in the sector given automation-related improved ergonomics, process flexibility, shifts in tasks, new tasks
  - Digitalisation enhanced / Virtual training – simulation

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Thanks

Research in South Africa draws on extensive field work conducted with **Dr Guendalina Anzolin**. With thanks to the Department for Trade and Industry (dti) and companies for access.