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Department:
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Determinants of digital technologies' adoption in South African manufacturing: Evidence from a firm-level survey

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TIPS Forum 2022

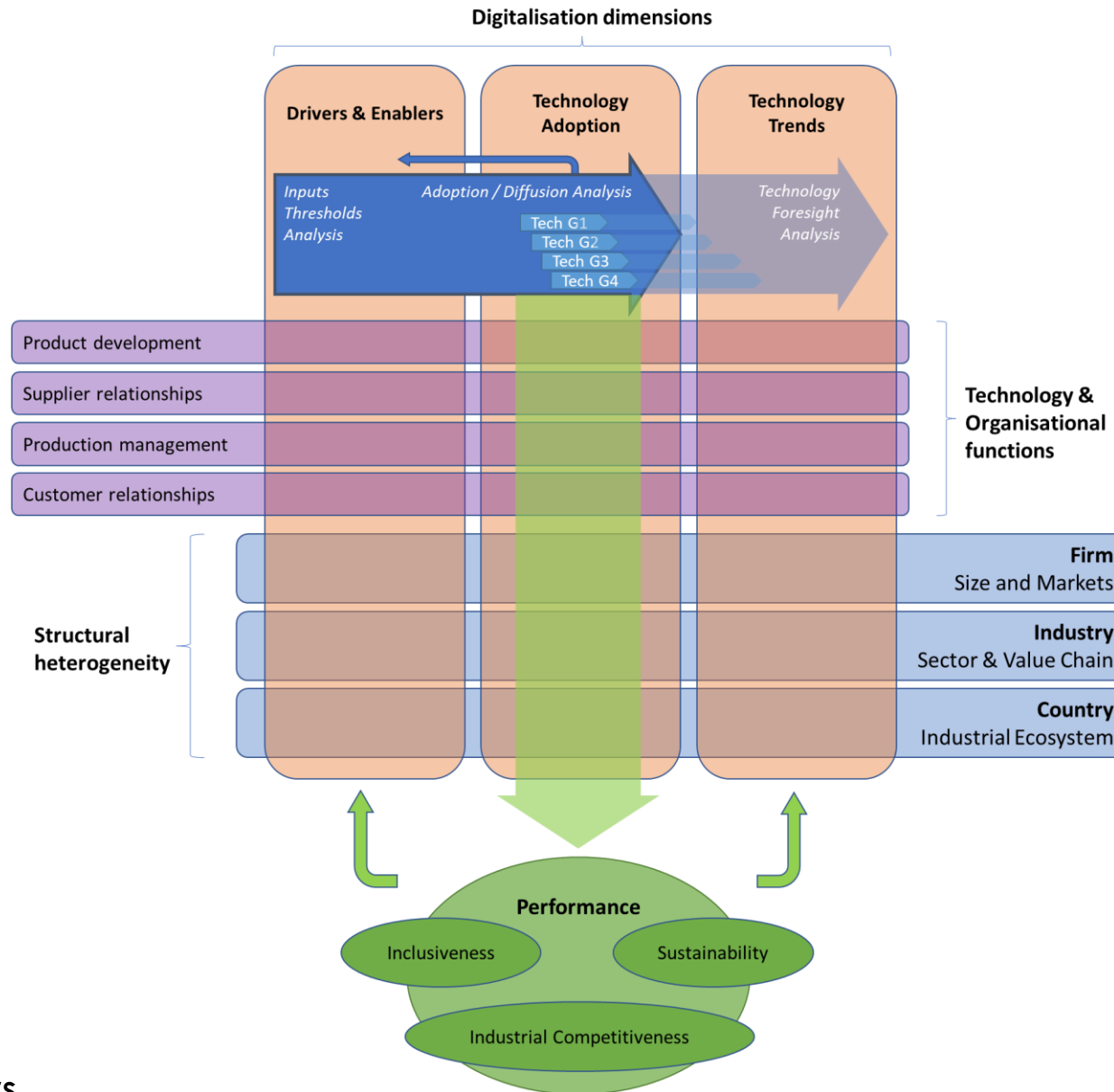
01-02 August 2022

Existential dilemma – industrial development and climate change



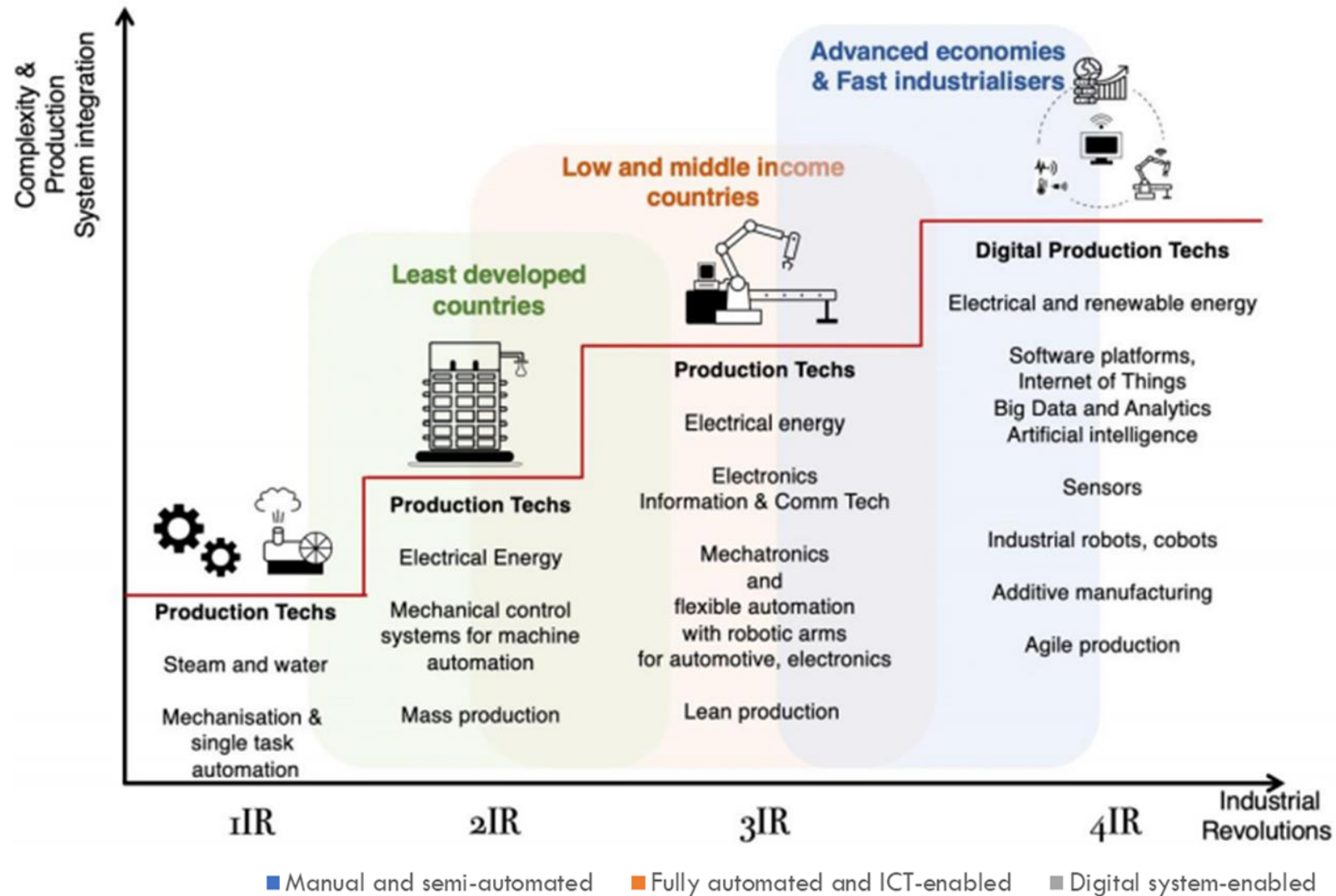
- ❑ Importance of digital industrialisation for sustainable re-industrialisation (CCRED, 2019)
 - ❑ Advanced manufacturing and automation mitigate climate change; integration in value chains
- ❑ South Africa is unprepared to fully adopt and adapt frontier digital technologies for sustainable structural transformation (IDTT 2022; DCDDT 2021; CCRED, 2019)
 - ❑ General lack of understanding of digital industrialisation in SA firms
- ❑ Research aims to analyse digital technology adoption in South African manufacturing firms

Multi-level framework to analyse digitalisation



Authors

Defining digital technologies



Source: Andreoni and Anzolin (2019)

Table 1: Basic descriptive of digital technologies

Generations of digital technologies	Functional Process	Basic technology classification
G 0.0 & 1.0	Analogue and rigid processes	Manual and semi-automated
G 2.0	Lean processes	Fully-automated and ICT-enabled
G 3.0 & G.4.0	Integrated and smart processes	Digital system-enabled

Source: Based on Kupfer et al. (2019)

□ The Digital Skills Survey 2021

- Collaboration between the IDTT and SARChI-ID, supported by the DTIC
- SETAs: manufacturing and engineering services (MerSETA), chemicals (CHIETA), and textiles and fibre processing (FP&M SETA)
- Conducted in March 2021, via emails using standard survey questionnaire: LA cases; UNIDO

Table 2: Breakdown of survey

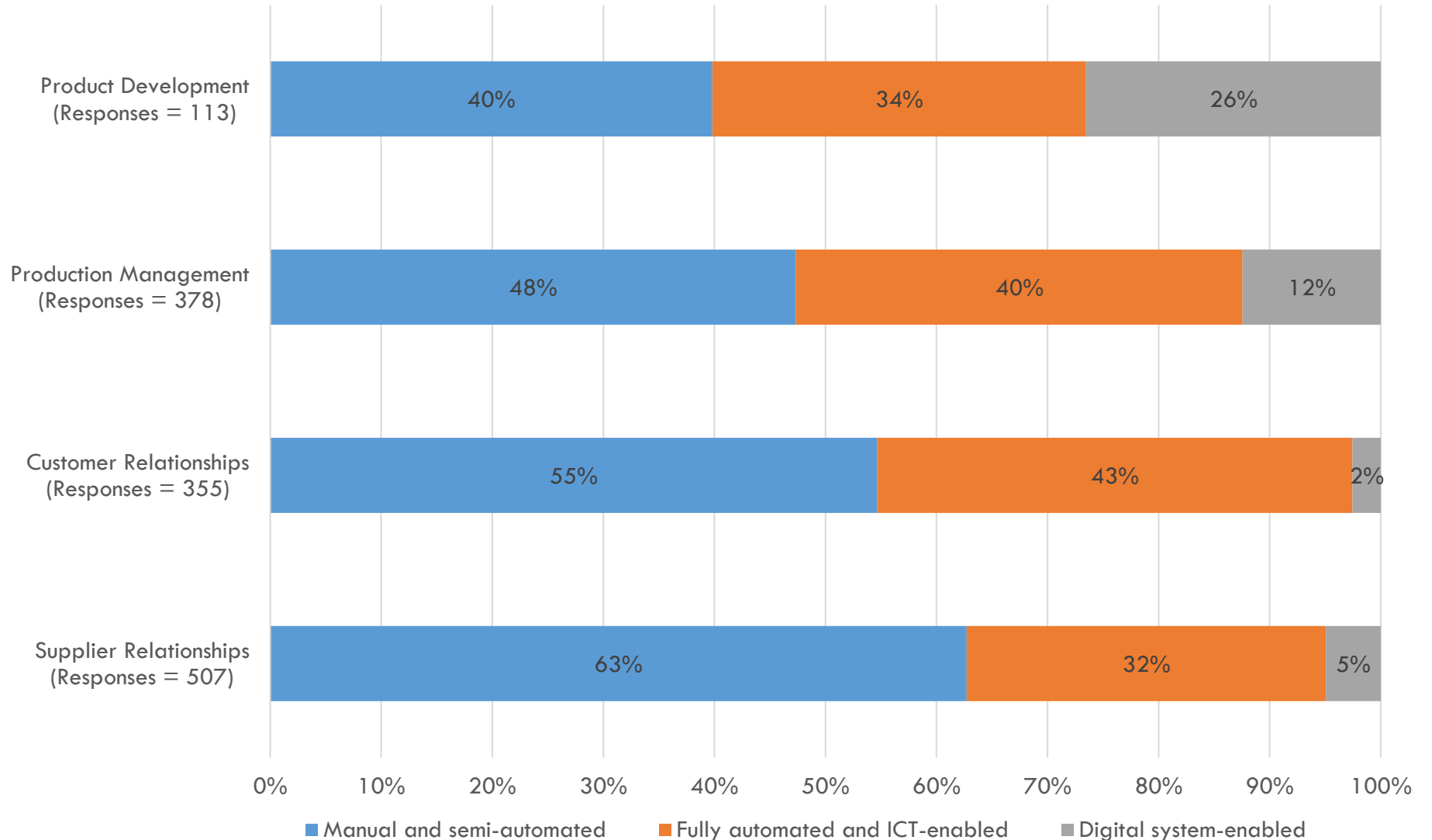
Invitations	7,432
Response Rate	≈7%
Total Responses	516 MerSETA (67%); CHIETA (17%); FP&M (16%)

- Use knowledge gleaned from a unique online survey of three manufacturing sector education and training authorities (SETAs) - CHIETA, MerSETA, and FP&M

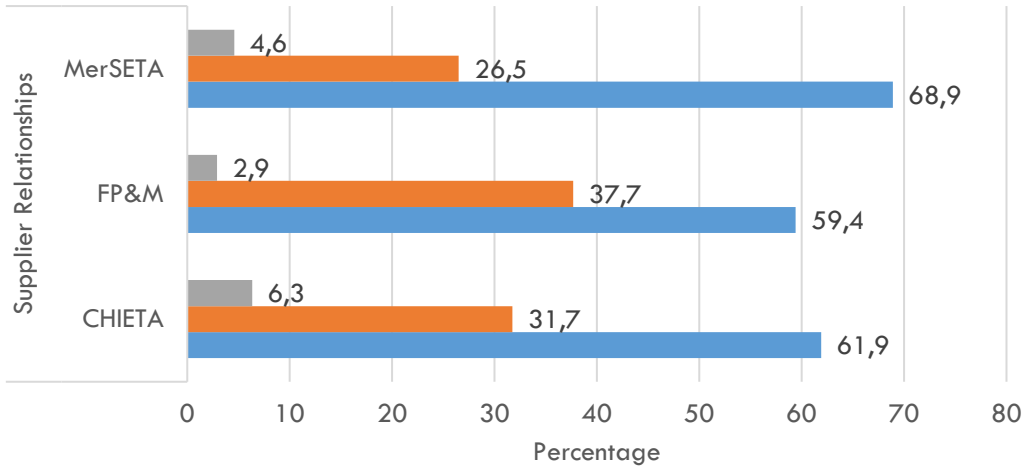
Technology classifications by business function

❑ Firms reliant on manual and semi-automated technologies

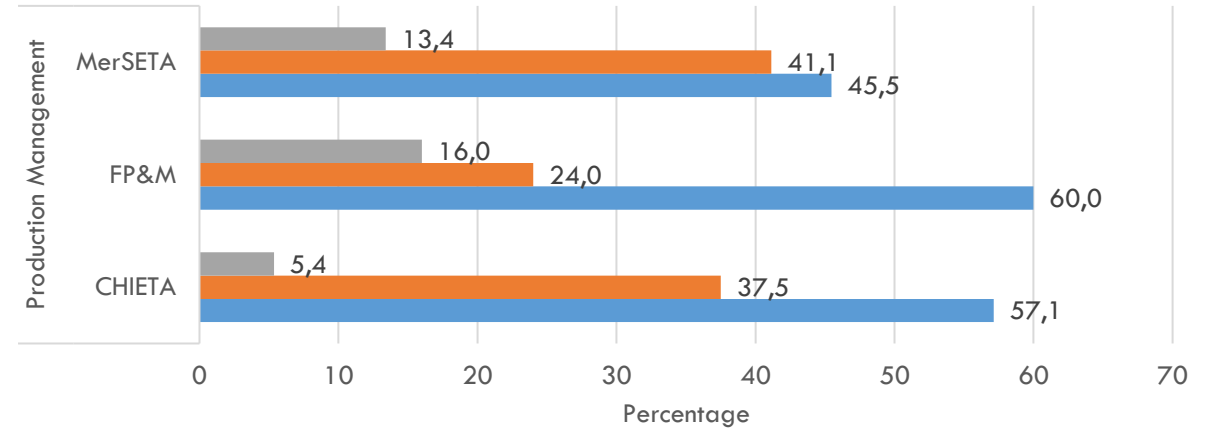
❑ PD and PM have higher adoption rates of more advanced technologies



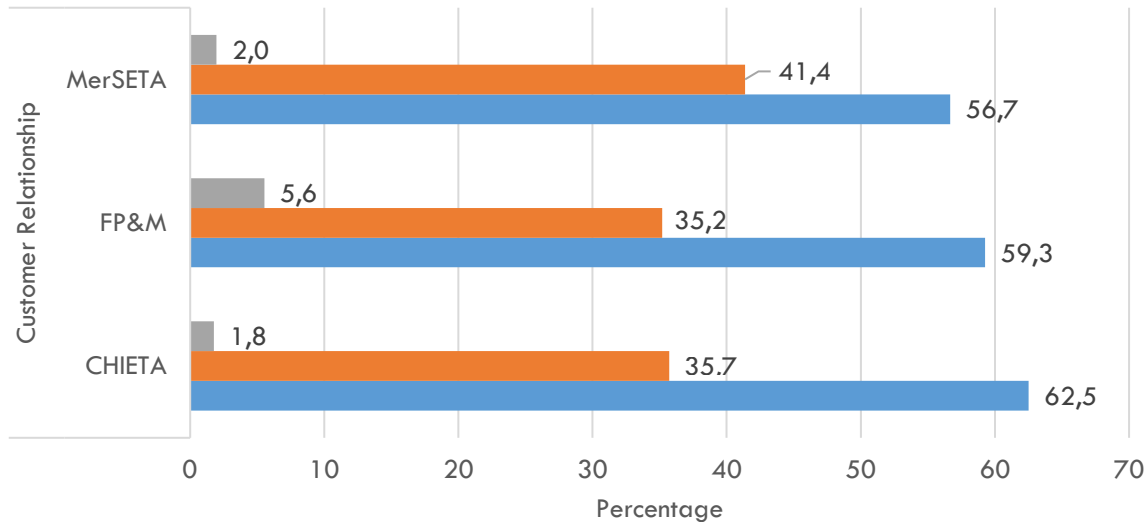
Status quo of technology infrastructure: SETA breakdown by business function



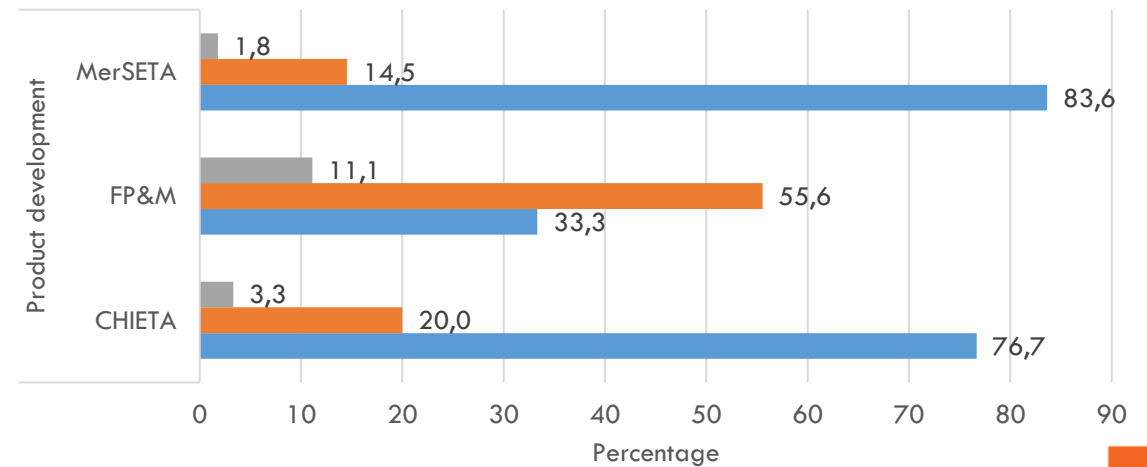
■ Digital system-enabled ■ Fully automated and ICT-enabled ■ Manual and semi-automated



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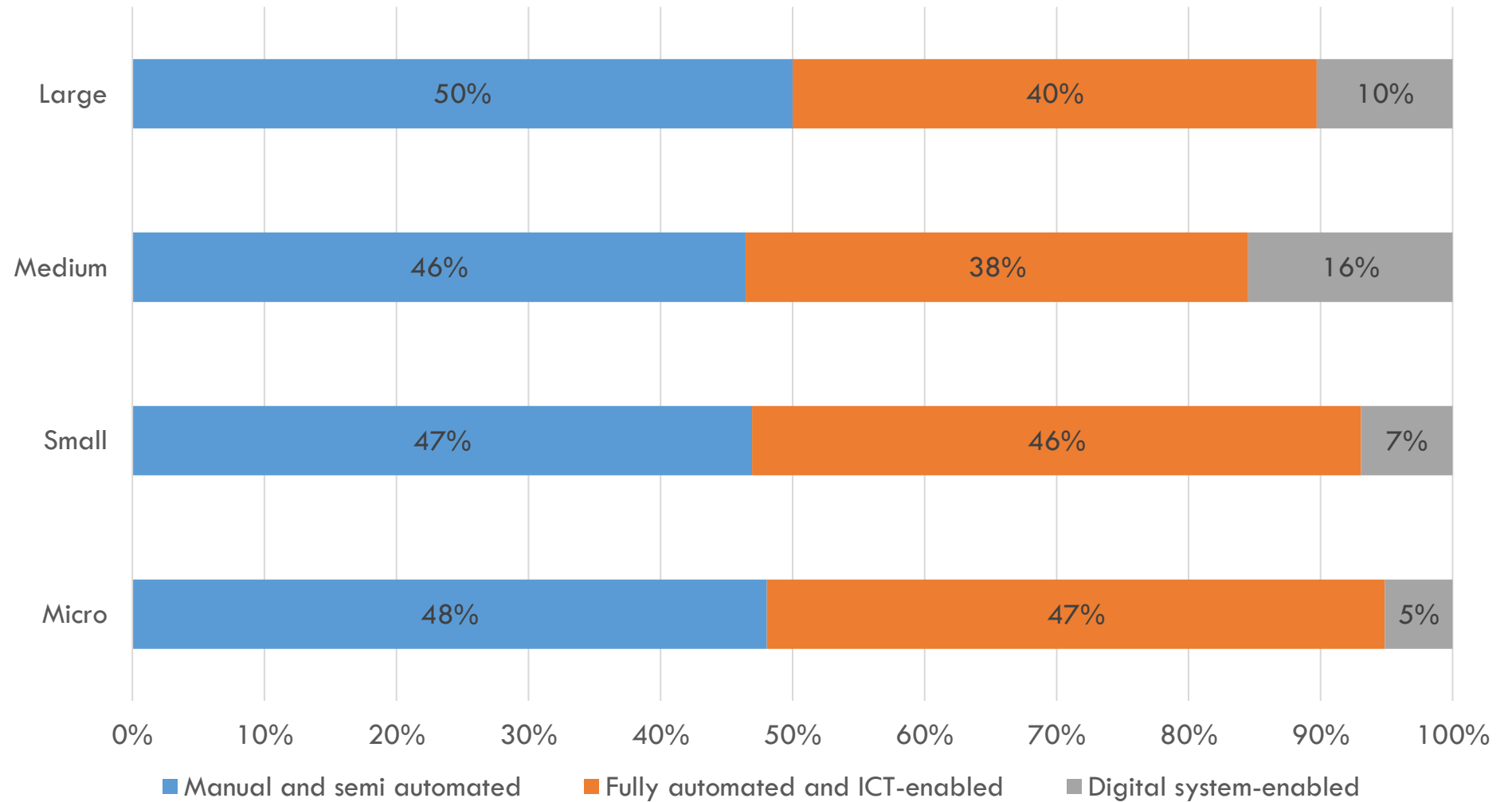


■ Fully automated and ICT-enabled ■ Digital system-enabled ■ Manual and semi-automated



Technology by firm size

- ❑ Medium-sized firms leading adoption of digital system-enabled technologies
- ❑ Micro- and small-sized firms dominating in automation and ICT-enabled technologies

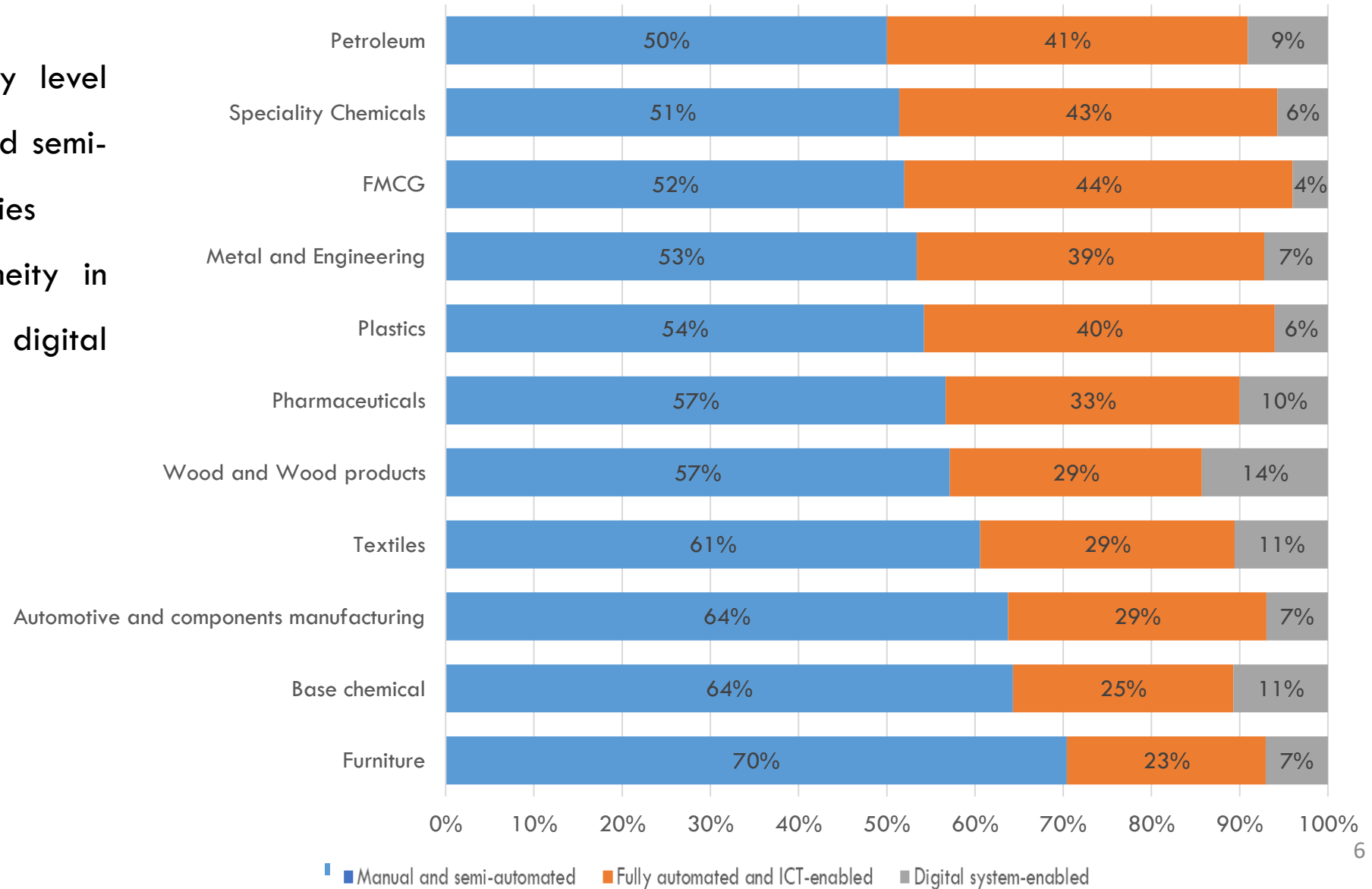


Source: Authors

Notes: Small - Sales valued at between R11 and R50 million in the 2019/20 financial year, Medium - Sales valued at between R51 and R250 million 2019/20 financial year, and Large - Sales valued at more than R250 million 2019/20 financial year.

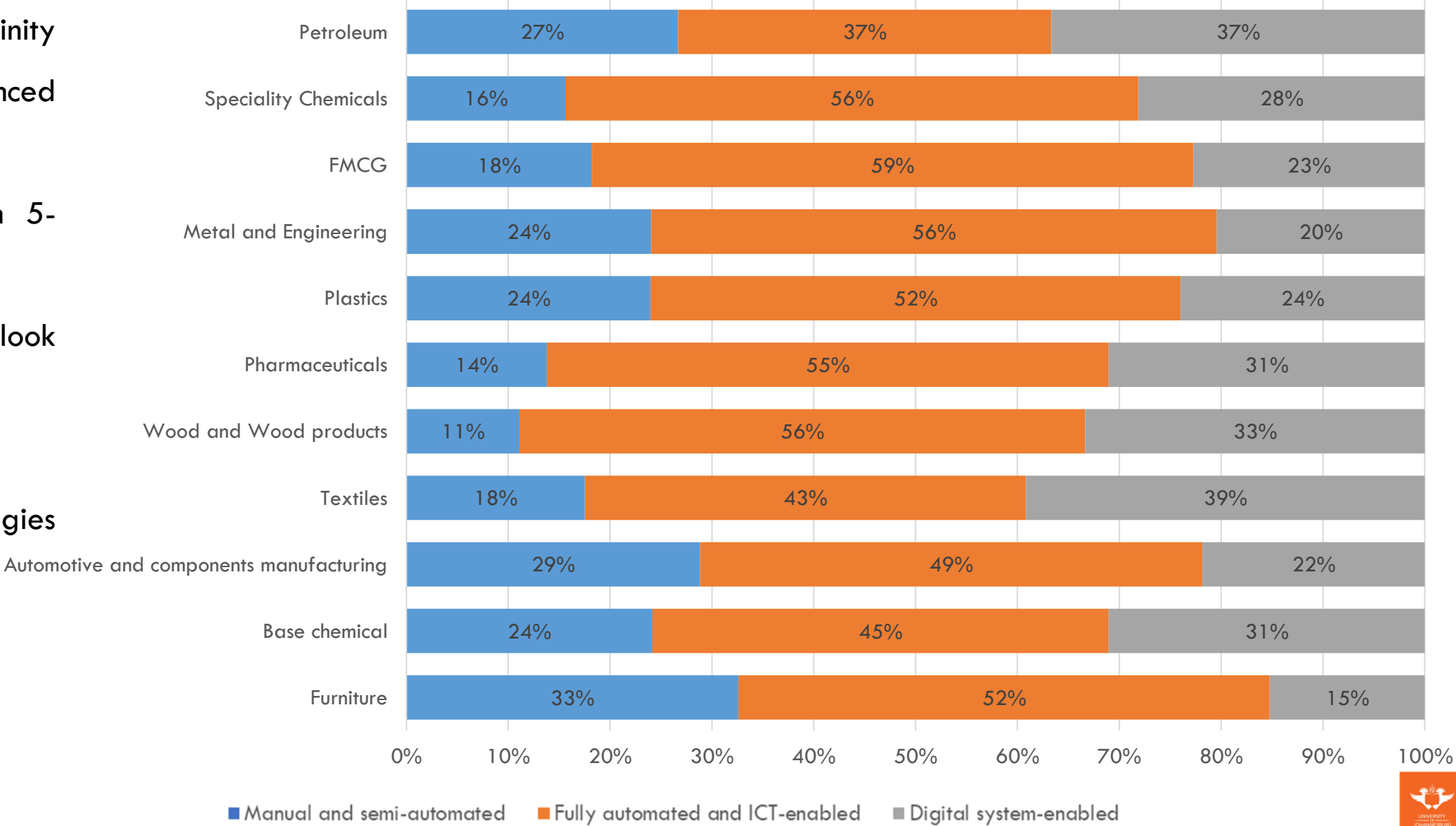
Status quo of technology infrastructure: Industry breakdown

- ❑ Firms at the industry level reliant on manual and semi-automated technologies
- ❑ Observed heterogeneity in adoption of digital technologies
 - ❑ Leaders
 - ❑ Laggards



Future orientation – Industry

Marked affinity towards advanced digital technologies in 5-10 years
 Positive outlook towards incremental adoption strategies

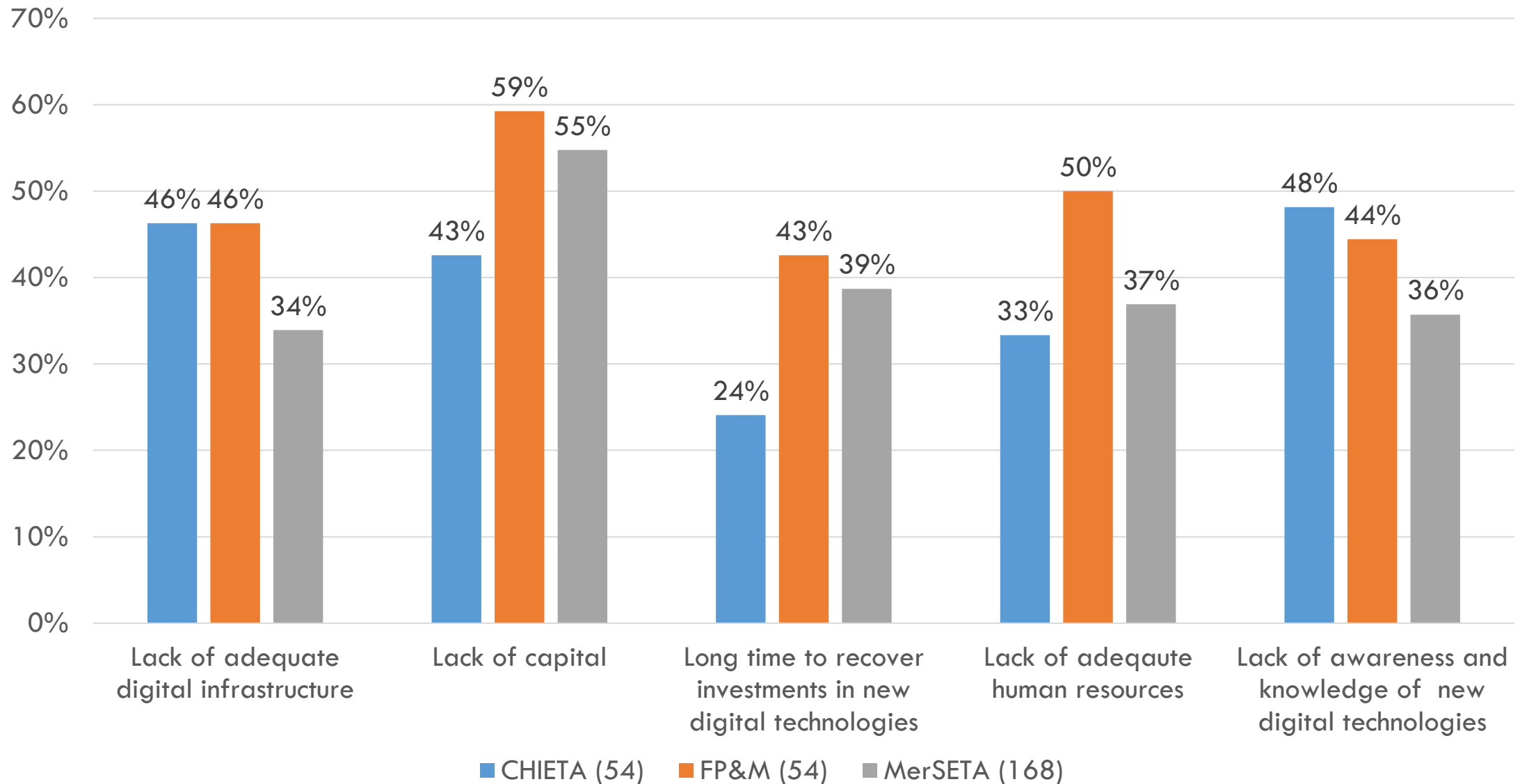


- To separately identify and examine the determinants of digital technology adoption across different business functions for which we have good data, we estimate three simple multivariate probit models: SR; CR; PD

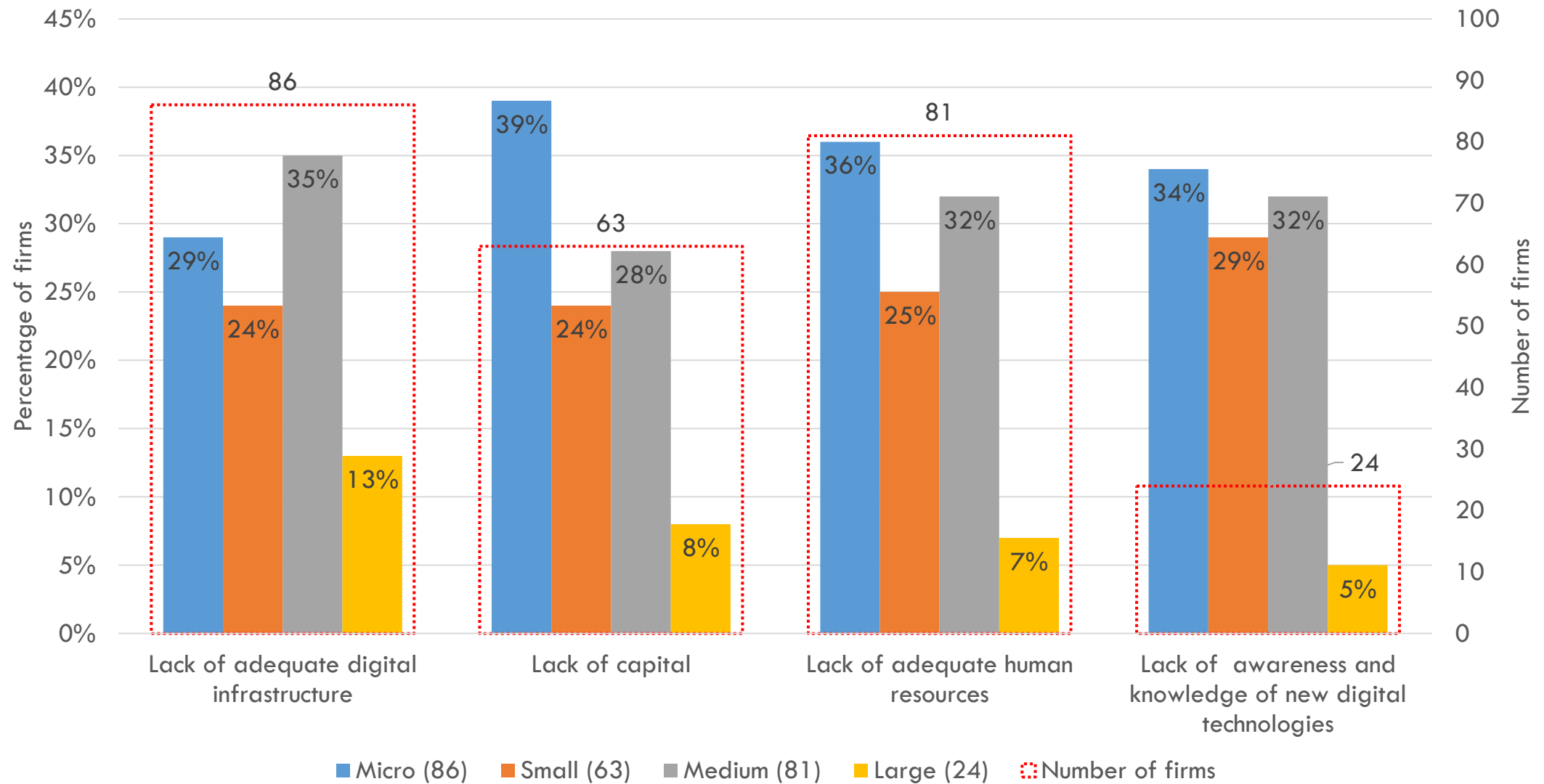
- Grouped firm-level variables into six categories following Baldwin and Lin (2002):
 1. Institution-related constraints (infrastructure, training centres, ect);
 2. Cost-related constraints (lack of capital);
 3. Information-related constraints (lack of awareness);
 4. Labour-related characteristics;
 5. Organisation-related characteristics (R&D);
 6. Firm characteristics (Age, location, sales, etc)

- ❑ Results show a mix of factors that influence the adoption of digital technologies across the three business functions under consideration.
- ❑ Cost-related constraints = crucial determining factor of adoption.
 - ❑ Supplier and customer relations business functions most affected
- ❑ Human capital is essential for the adoption of digital technologies across the functions.
 - ❑ Emphasising the importance of STEM skills.
- ❑ Older, export-orientated, and foreign-owned firms displayed higher degrees of digital technology adoption.
 - ❑ Across all business functions.

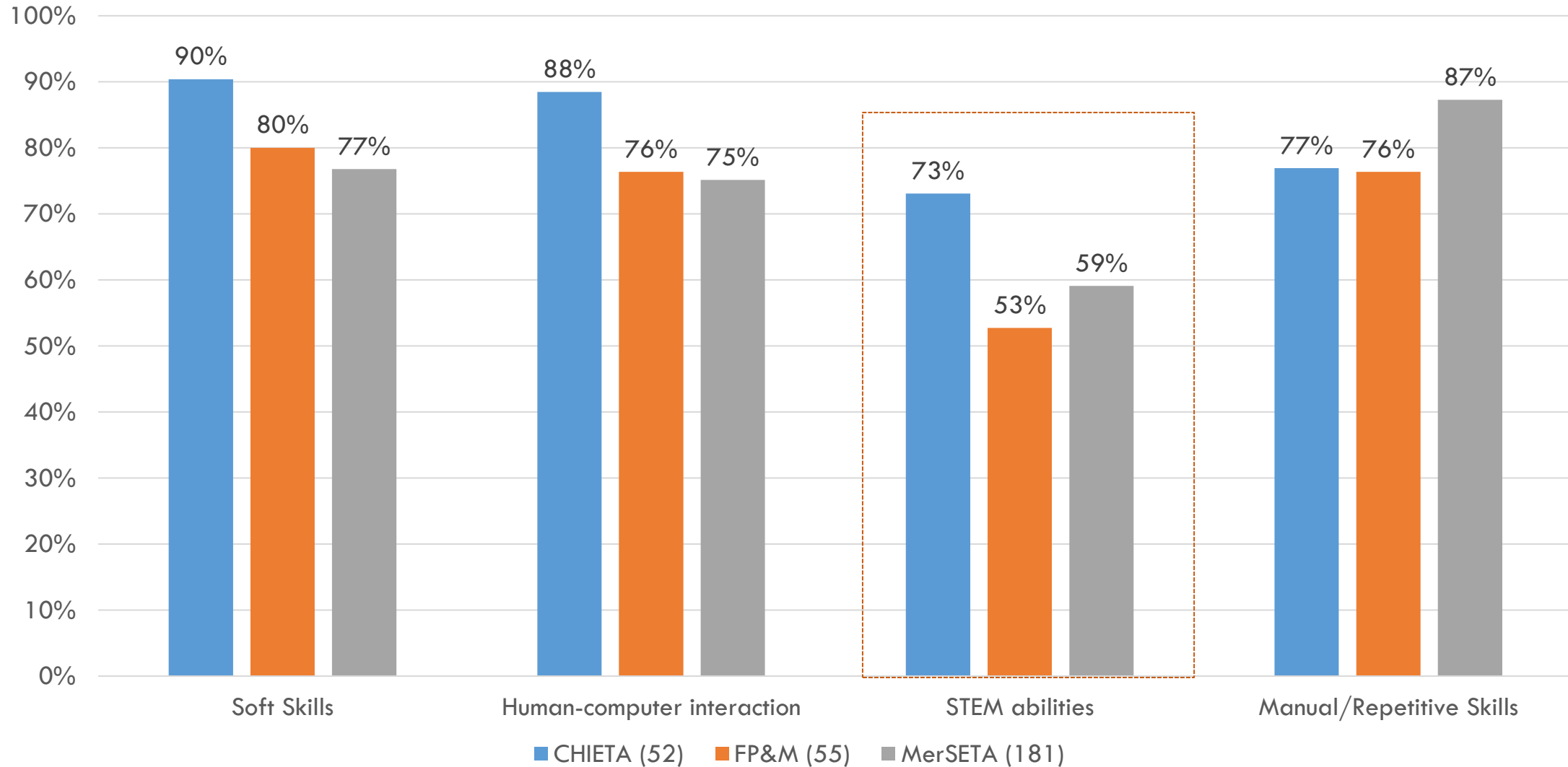
Factors affecting technology adoption (SETA-level)



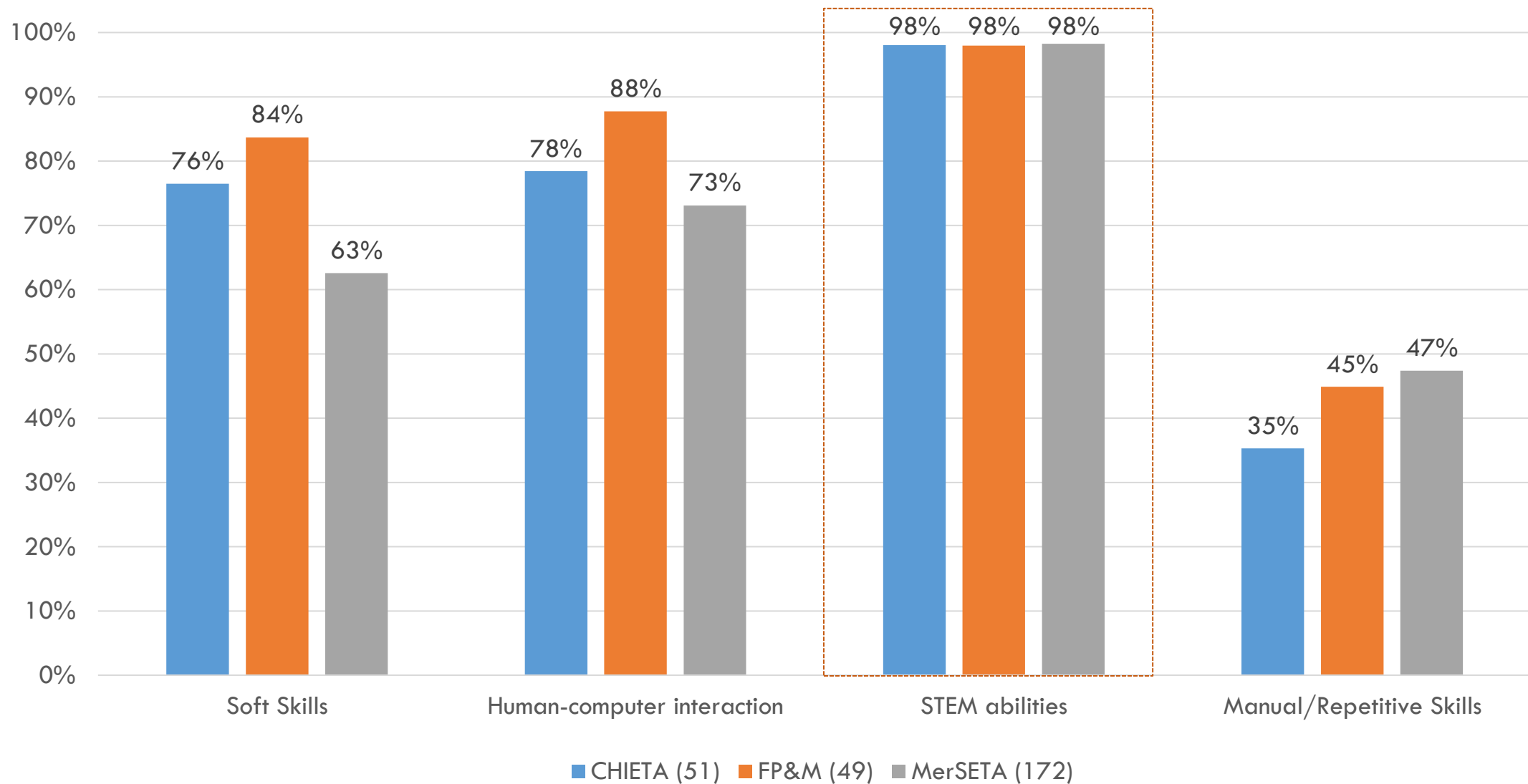
Factors affecting technology adoption (Firm level)



Skills and Digital Technologies – Important skills when hiring (SETA breakdown)



Skills and Digital Technologies – Difficulty in finding skills (SETA breakdown)



- ❑ Digital industrialisation fundamental to structural transformation
 - ❑ Escape middle-income technology trap
- ❑ Inequality between firms in the adoption and use of advanced digital technologies
 - ❑ Uneven speed and scale
- ❑ Digital divide across several levels of analysis (SETA, industry, and firm size)
- ❑ These findings have potential to influence policy discussions on specific firm- and industry-level characteristics to drive digital transformation in South Africa.
 - ❑ Heterogeneity => targeted policies
 - ❑ Findings cannot be generalized for all SETAs because the survey is in its first iteration.
- ❑ Opportunities for future iterations.

Thank you!
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