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Digital heterogeneities in developing countries: a comparative analysis and related policy implications

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The 106th GIST Seminar
National Graduate Institute for Policy Studies,
Tokyo, Japan
November 24th, 2022

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Acknowledgments

- **Julia Torraca, Jorge Britto and Ana Urraca-Ruiz are my co-authors**. Julia is a colleague at IE/UFRJ; Jorge and Ana are professors of economics at the Universidade Federal do Rio de Janeiro, Brazil

- This presentation is based on a preliminary version of our article **Digital heterogeneities in developing countries: a comparative analysis** submitted and under revision for the journal Revista Brasileira de Inovação

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Guide to the presentation

Questions

The approach

The evidence

Reflections and policy implications

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The exercise, the hypothesis, the questions

The exercise: to identify similarities and differences in the adoption of digital technologies by industrial firms in five developing countries: Argentina, Brazil, Ghana, Thailand, and Vietnam

Hypothesis: the existing heterogeneity in production structures of developing countries imply a heterogenous pattern of digital adoption

Questions

- Digital technologies: development window of opportunity?
- Current and expected digital progress of industrial firms in different countries?
- Who is lagging behind, catching up, forging ahead?
- Digital progress or divide in the making?
- Policy challenges?

Source of inspiration: Abramovitz, M. (1986)

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Panel by size and sector

Country	Size	Technology Intensity		Total
		H-M-H	L-M-L	
Argentina (2018)	Large	9	4	13
	Small	95	96	191
	Total	**104**	**100**	**204**
Brazil (2017/18)	Large	103	106	209
	Small	90	47	137
	Total	**193**	**153**	**346**
Ghana (2019)	Large	0	30	30
	Small	0	170	170
	Total	**0**	**200**	**200**
Thailand (2019)	Large	43	18	61
	Small	71	68	139
	Total	**114**	**86**	**200**
Vietnam (2019)	Large	43	44	87
	Small	79	96	175
	Total	**122**	**140**	**262**
Total		**533**	**679**	**1212**

Attention!

- Data is based on direct surveys to a limited number of industrial firms.
- Size and Tec intensity: the sole 2 common homogenising factors
- This is not an expansible panel, statistically representing industries in each country.
- But panel provides interesting insights into what may be happening

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Basic economic indicators

	World	ARG	BRA	GHA	THA	VIET
GDP growth (annual %) - Mean 2000-2020	2,61	1,42	2,12	5,80	3,50	6,31
GDP per capita growth (annual %) Mean 2000-2020	1,39	0,37	1,10	3,30	2,94	5,26
Gross fixed capital formation (% of GDP) - Mean 2000-2019	23,63	15,92	18,01	21,77	24,35	28,46
Trade (% of GDP) Mean 2000-2019	56,40	33,00	25,91	81,95	126,35	154,95

Very different countries. Do they also differ in their digital adoption?

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The approach

Inherent features of the digital & implications on businesses

Systematic falling costs

+

Wide-ranging applications

+

Market growth

+

Technology convergence

=

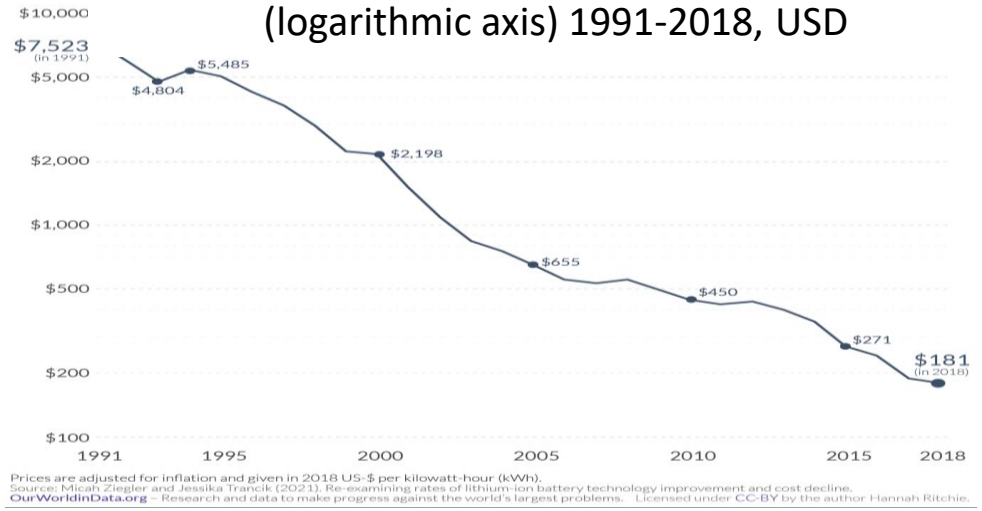
Integration, interconnection, intelligence…

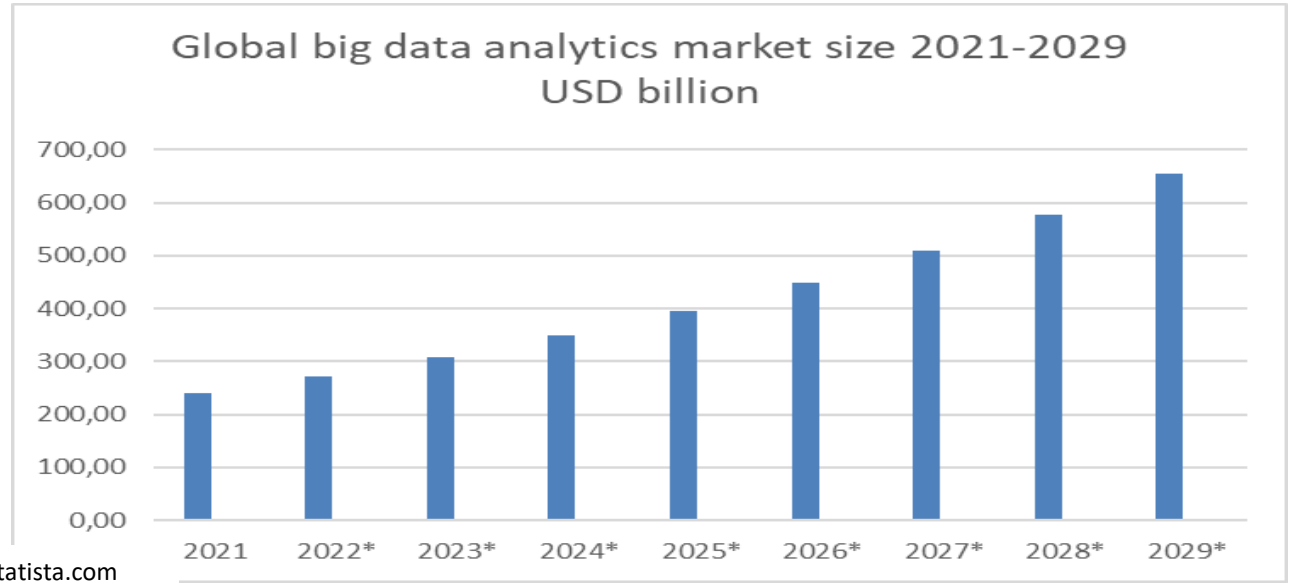
Efficiency, product & service diversification and customisation, lead time, flexibilities…

High transformation potential of business models, competitive drivers and, eventually, even market structures

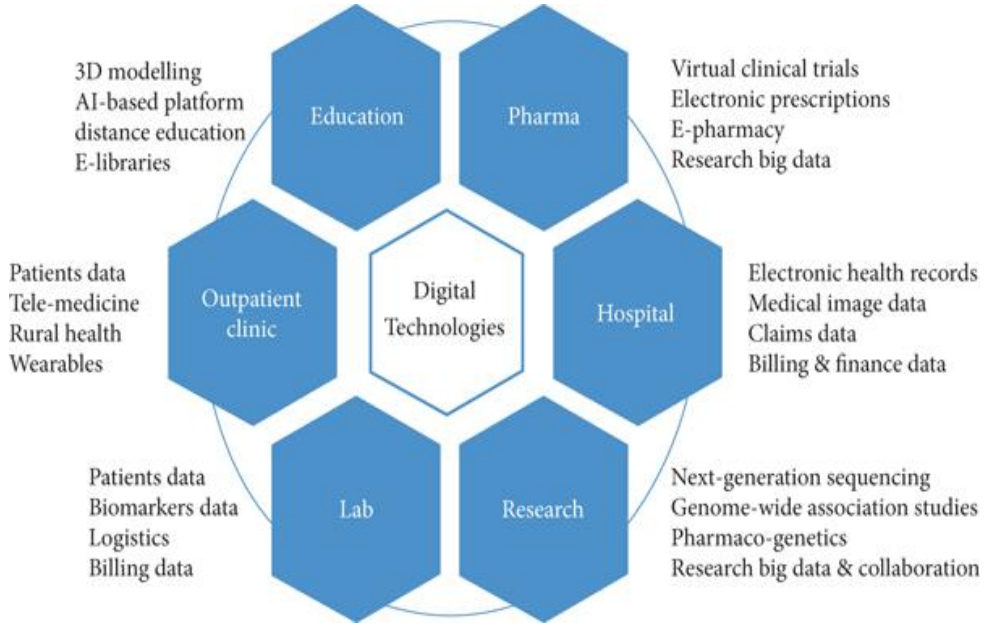
Costs & markets; applications & convergence

Price of Lithium-ion battery per kWh (logarithmic axis) 1991-2018, USD

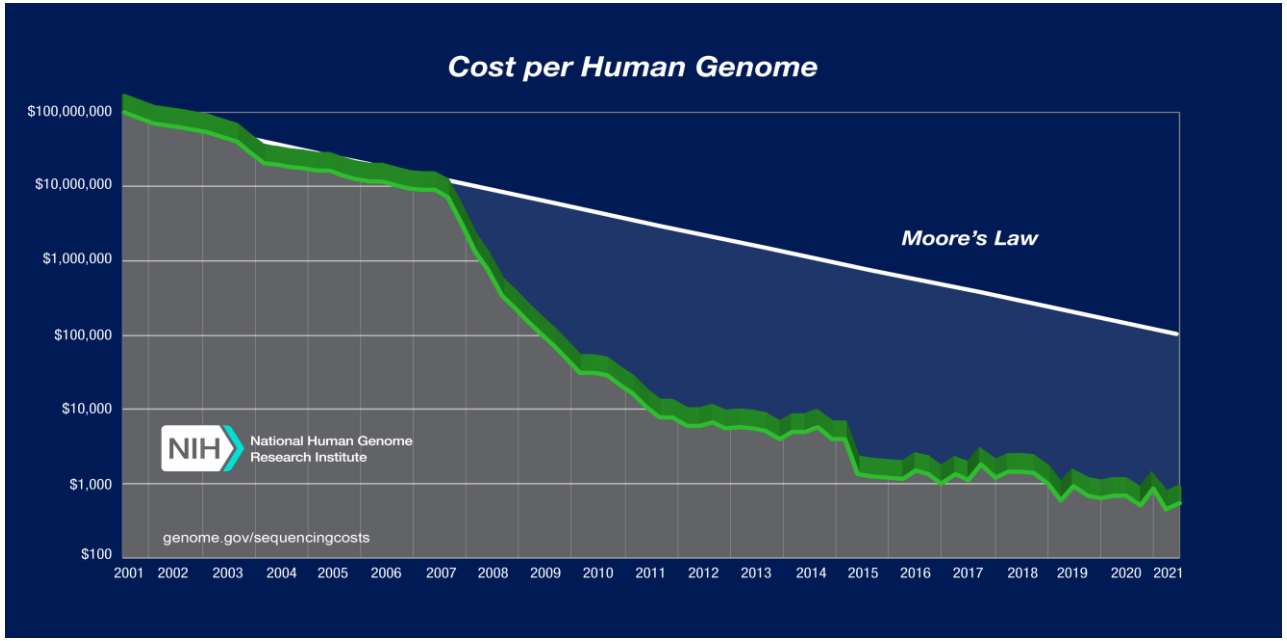




Source: Statista.com



Source: Senbekov et al (2020)



Source: Genoma.gov

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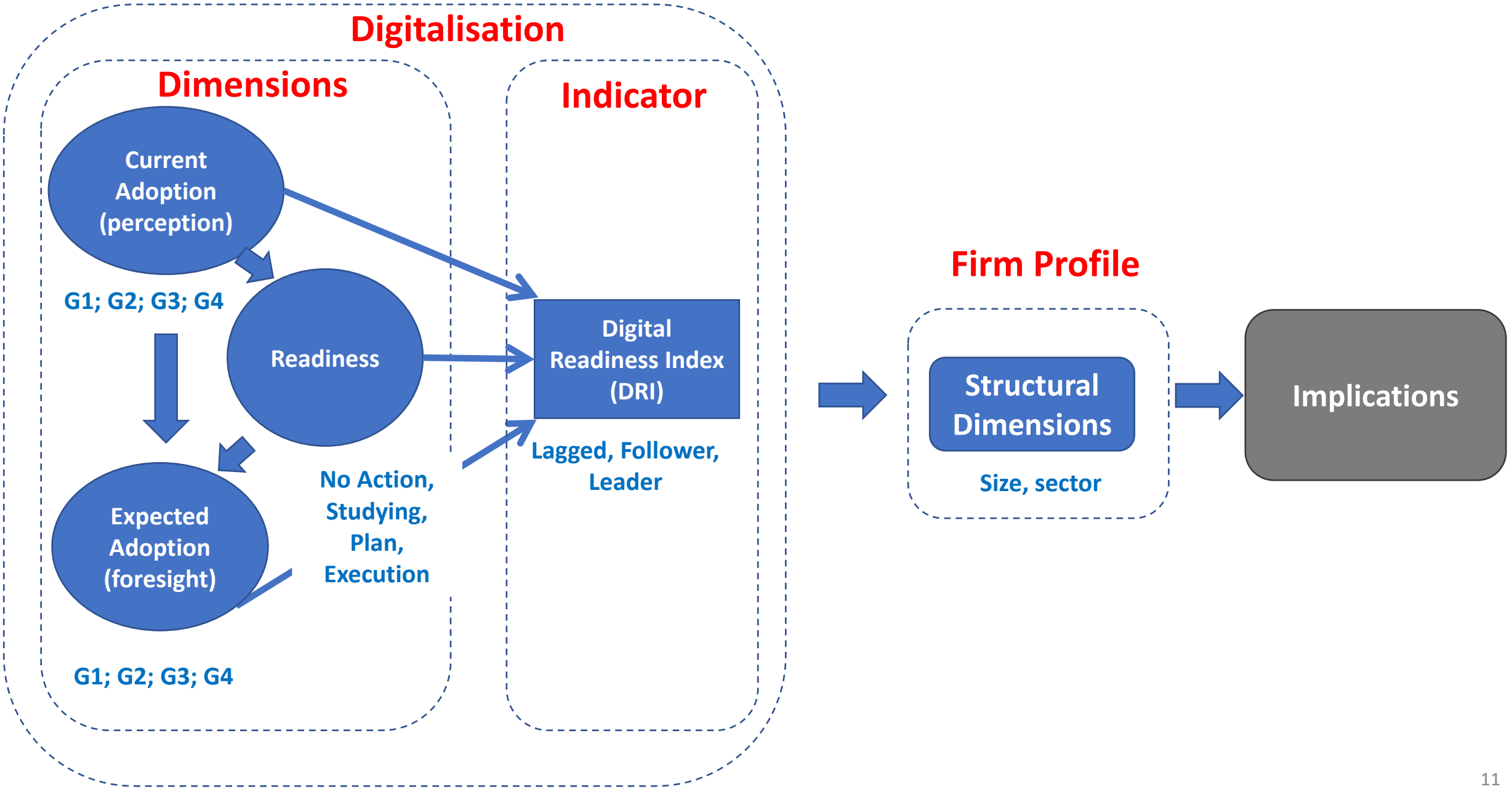
The methodological approach: Digital Generations in Business Functions

Generation	Supplier relationship	Product development	Production management	Client relationship	Business management	Current	Future
G1	Manual transmission of orders (fax)	Stand-alone computer aided design -CAD	Stand-alone automation	Spread sheet registry of contacts	Information systems by area/department		
G2	Electronic transmission of orders (email)	CAD - CAM	Partially or fully integrated CAM	Automated devices to support sales	Enterprise resource management in few areas		
G3	Digital system for processing orders, stocks & payments	Integrated data product system	Process execution automated system	Internet based support for sales & after services	Integrated platform to support decision making		
G4	Real time web-based relation	Virtual modeling	Machine to Machine - M2M system	Client relations based on-line product monitoring	Management supported by big data analytics		

Readiness: What is the firm currently doing to prepare for the projected future? Nothing? Studying solution? Planning actions? Implementing actions?

The analytical framework



Digital Readiness Index

$$DRI = \text{Firm}_{go} + (\text{Firm}_{gf} - \text{Firm}_{go}) * \alpha$$

Firm_{go} = Current digital adoption
Firm_{gf} = Expected digital adoption
$\alpha = (\text{Firm}_{a} - 1)/3$

$$\alpha = \begin{cases} 0 \text{ if } \text{Firm}_a = 1 \text{(no action)} \\ 0.33 \text{ if } \text{Firm}_a = 2 \text{ (studying)} \\ 0{,}66 \text{ if } \text{Firm}_a = 3 \text{ (have a plan)} \\ 1 \text{ if } \text{Firm}_a = 4 \text{ (plan in execution)} \end{cases}$$

Range 1-2, 2-3, etc = average of 5 functions or 4 readiness

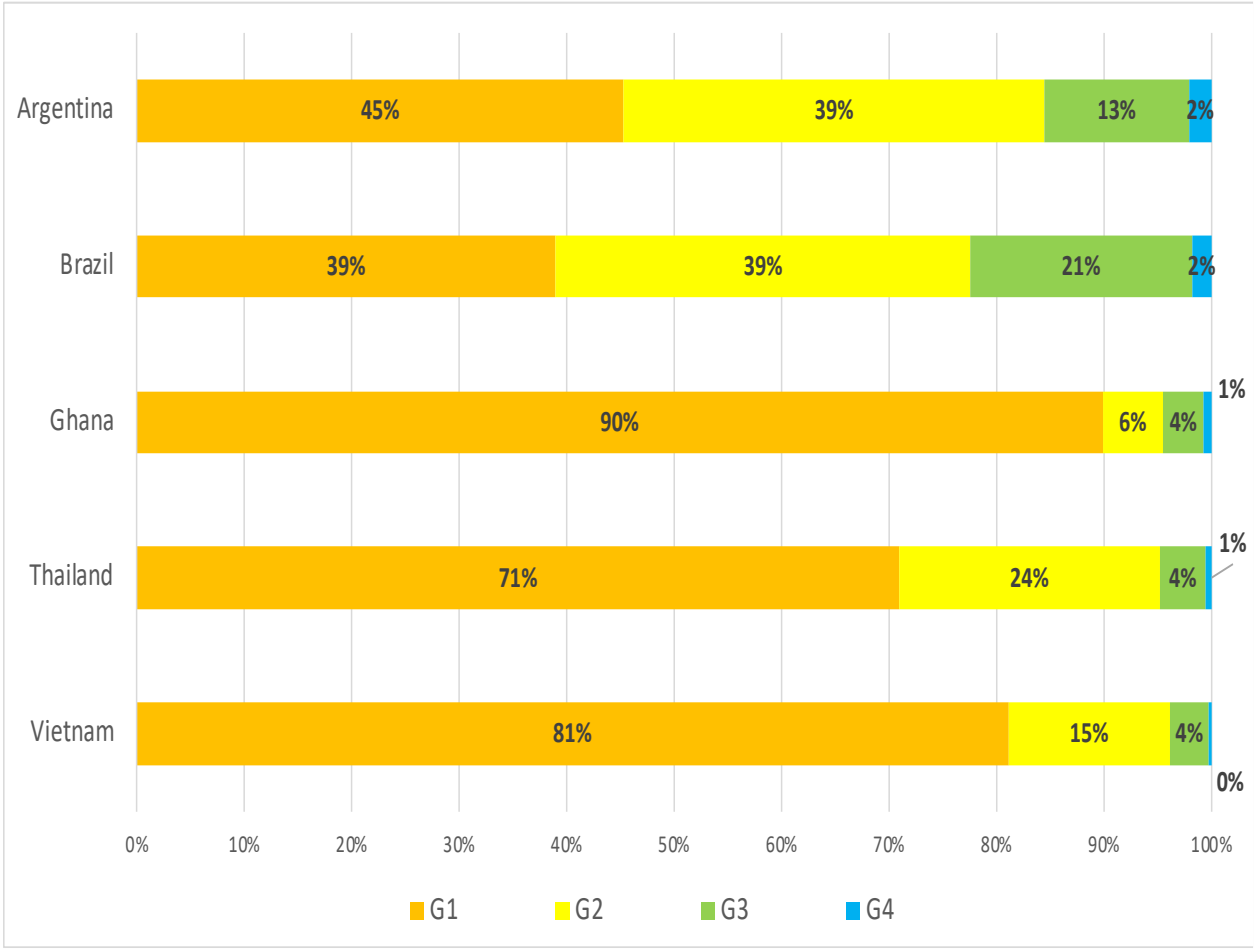
Average of G0	Average of Gf	Average of Readiness		
		1-2	2-3	3-4
1-2	1-2	L	L	L
	2-3	L	L	C
	3-4	L	C	C
2-3	2-3	L	C	C
	3-4	C	C	F
3-4	3-4	F	F	F

Lagging Behind **Catching-up** **Forging Ahead**

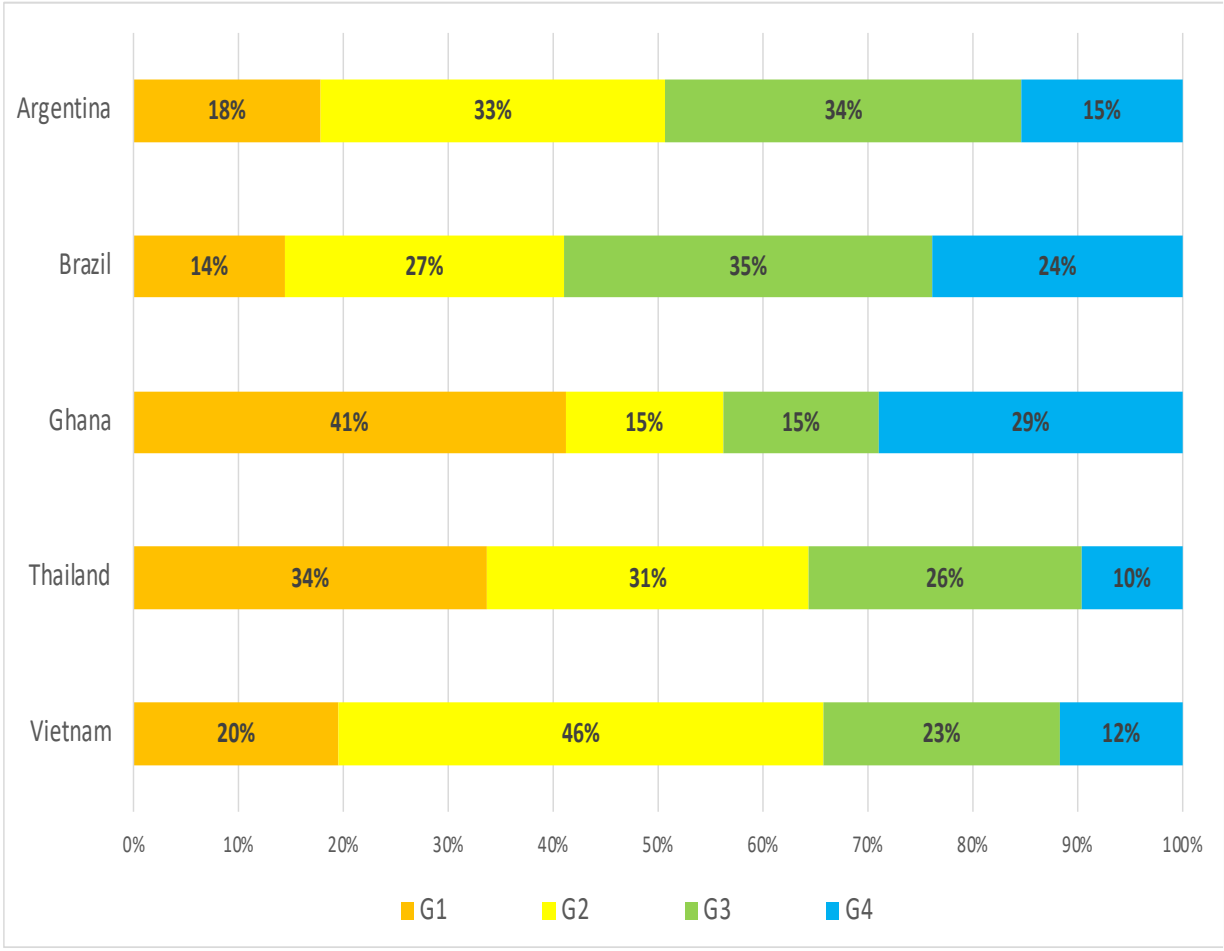
The evidence

Current and expected digital adoption by country

Current

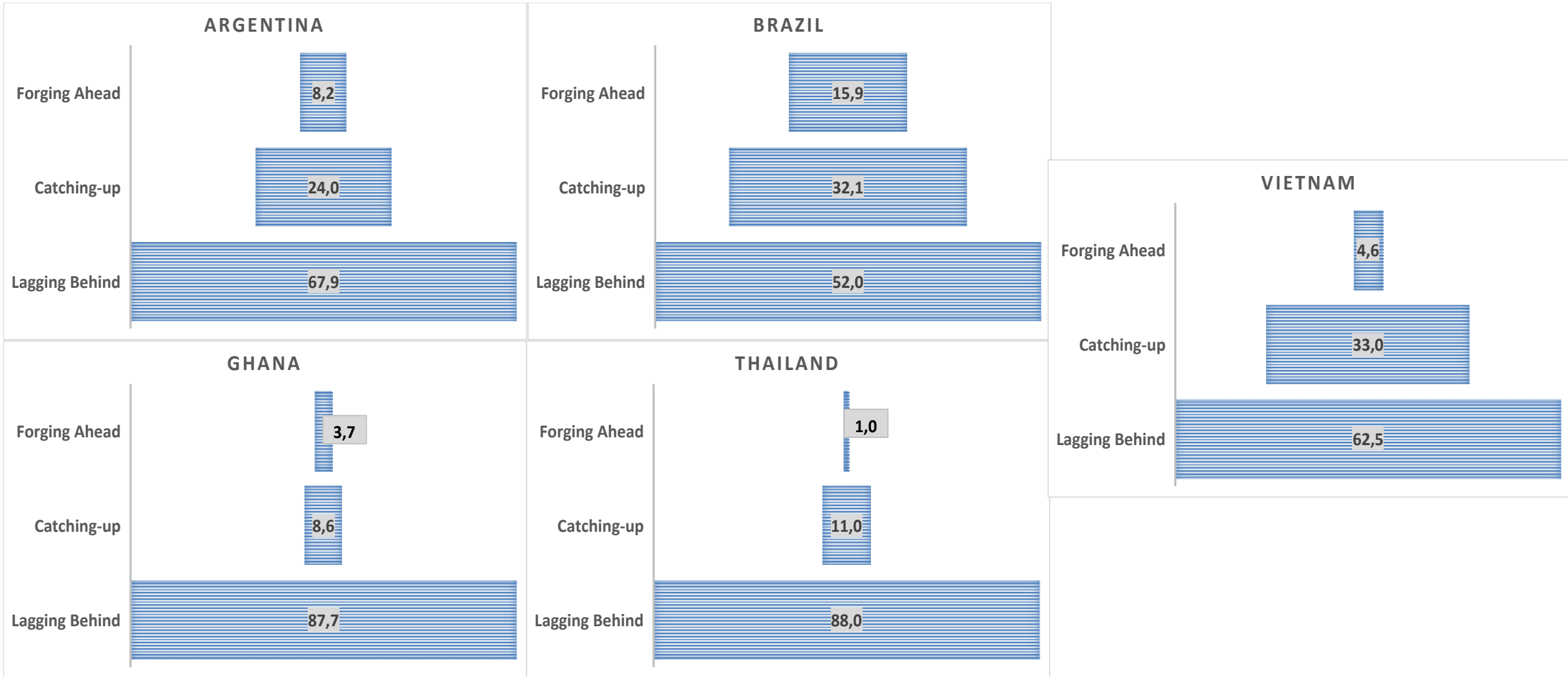


Expected



Current: basic digital generations prevail. Future: progress is expected. Country differences. How sound can expectations be?

Country level Digital Readiness Index: a general view



Lagging behind firms prevail in all countries.
Country differences. Arg, Bra, Viet: higher proportion of catching up and forging ahead firms

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Digital Readiness Index by size

Country	Lagging Behind	Catching-up	Forging Ahead
All			
L-ML	53,9	32,6	13,5
S-MS	75,4	19,7	4,9
Argentina			
L-ML	15,4	76,9	7,7
S-MS	71,6	20,2	8,2
Brazil			
L-ML	48,8	33,0	18,2
S-MS	56,9	30,7	12,4
Ghana			
L-ML	65,2	26,1	8,7
S-MS	91,4	5,8	2,9
Thailand			
L-ML	83,6	14,8	1,6
S-MS	89,9	9,4	0,7
Vietnam			
L-ML	48,3	39,1	12,6
S-MS	69,5	29,9	0,6

Countries´ similarities

Proportionally, larger firms are more digitally advanced compared to smaller peers

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Digital readiness index by sector

Country	Lagging Behind	Catching-up	Forging Ahead
All			
H-MH	57,1	31,5	11,4
L-ML	77,3	17,9	4,9
Argentina			
H-MH	57,6	30,3	12,1
L-ML	78,4	17,5	4,1
Brazil			
H-MH	49,2	31,1	19,7
L-ML	55,6	33,3	11,1
Ghana			
L-ML	87,7	8,6	3,7
Thailand			
H-MH	85,1	14,0	0,9
L-ML	91,9	7,0	1,2
Vietnam			
H-MH	43,0	49,6	7,4
L-ML	79,3	18,6	2,1

Countries´ similarities

Firms belonging to hitec-intensive activities proportionally are digitally more advanced compared to low and medium low tec firms

Reflections and policy implications

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Before reflections…

Points of attention

- Countries have **different structural conditions** which does affect current and expected digitalisation

- **Panel features do matter**. Who were the 200 Thai or the 200 Vietnamese firms? How were they mobilised to answer the survey? As said before, country panels not representative of their industries.

- **Limited relational variables** (size, sector) bring to fore only two of relevant structural features. Other variables (macro, firm behaviour), not available. Worth investigating. In the case of Brazil, behaviour variables, very important

- Still… the exercise does provide **interesting insights on differences and similarities**

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Findings

- **Differences**: More digital catching up and forging ahead firms in Argentina, Brazil and Vietnam. Panel features?
- **Similarities**: Very basic generations of digital technologies are currently adopted by industrial firms in all countries. Some progress projected for the future. But limited presence of digital catching up and forging ahead firms
- **Similarities**: Size and sector of origin matter: catching up and forging ahead firms tend to be of larger size and coming from technology intensive sectors compared to their peers

If digitalisation implies transformation of business models, competitive drivers and even market structures... two reflections for business strategies and public policies

Reflection 1

- Even among the larger and hitec industries a relevant subset of firms lags behind.
- Unusual result. Companies with such profile, theoretically would have the resources to move digitalisation ahead. Not so. Why have they lagged behind? Ignorance? Business strategy? No competitive pressure?
- From a policy perspective, would it be advisable to support larger and hitec firms? On which grounds?

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Reflection 2

In the face of digital heterogeneities and digital related potential competitive advantages, 3 possible future scenarios (for all countries)

1. **Heterogeneity remains**. Digital differences (forging ahead and catching up vs lagging companies) will widen but the 3 groups will coexist, as they do today, as long as a demand for the latter exist (due to income differentials the wealth differentials each country, for example).

2. **Exclusionary homogeneity.** Differences between companies may cease. As a result of a process of competitive exclusion, disappearance of lagging behind companies.

3. **Inclusive homogeneity**. Access to digital solutions is widely diffused, laggards could move ahead. Digital inclusion. Digital differences among companies are minimised and chances of competitive survival for new digital comers increases.

Policy implications (according to stage of digital development)

- **Firms forging ahead**: **National champions**. Challenge: evolve along technological frontier by amplifying and diversifying competences. Policy target? For their own benefit or to induce multiplier/externality generation actions? Significant $ contribution from firms… obligatory.
- **Catching up firms. Wannabe**. Challenge: follow international best practices by expanding capabilities. Policy target? For all or for a targeted groups of firms (in specific locations or value chains, for example) with the purpose of further upgrading them and partners? Their financial contribution? A requisite.
- **Lagging behind**: **Underdeveloped**. Challenge: shorten distances to a productive frontier. Policy target? Most likely. Actions: financial support & technical assistance. In any case, at least a symbolic contribution from firms should be requested. Germany, Singapore and South Korea provide examples. THE policy challenge: universe of firms. Can a country effectively embark in massive digitalisation programmes? Or… should specific targets be aimed at? How to define targets? Priorities falls at the political level.

Policy challenges

New development challenges require policy innovation.
Open questions

- Are national digital strategies part of high-level political priorities?

- Are they coherent with other public policies? (e.g. macroeconomic policy)

- Are resources available?

- Are policy institutions efficient and effective? Can they work together?

- What is the quality of public-private concertation?

- Are monitoring, evaluation and account rendering instruments in place?

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