# Report #3
# Digital Technologies for Small and Medium Enterprises and job creation in Sub-Saharan Africa

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## Chair « Digital Trust »

*FERDI Webinar Series*

**Digital Trust: A condition for Africa's emergence**

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# Motivation & scope of the report

IMF (2020): 20 million jobs / year have to be provided in Sub-Saharan Africa (SSA) to absorb the growing workforce in the subcontinent.

The digitization of SMEs represents an important lever for wealth & job creation :

- Small African businesses employ around 80% of the workforce (World Economic Forum, 2015).
- < 60% of SMEs were using email and <30% used a website, against 90% of large firms (WBES).

This third report combines quantitative analysis using survey data on African SMEs with qualitative information on recent digital innovation the comprehension of the ongoing and forthcoming transformations induced by the diffusion of DTs among African SMEs.

# 1. Expected gains from DT adoption and diffusion for businesses

# 1.1. Digital technology adoption & business operations

**Digital technologies (DT)** are "the representation of information in bits […] rather than atoms", which "reduces the cost of storage, computation and transmission of data" (Goldfarb & Tucker, JEL 2019, p.3).

Digital technologies (DTs) are expected to reduce:

- Information search costs
- Replication costs
- Transport costs
- Tracking/targeting/verification costs

…with a beneficial impact on **market imperfections reduction** in all sectors of an economy.

Adoption of DTs can boost the **firm's inner operations**, through:

- improved input usage,
- information collection/processing for decision making and market expansion
- capacity building (learning & innovation)

Adoption of DTs can improve **the firm's business environment**, through:

- better access to G&S markets: enhanced market functioning + reinforced firm's market positioning
- better access to capital
- support formalization of informal businesses

**The benefits from DT adoption probably go beyond the strict conduct of business operations**

# 1.2. Digital technologies diffusion & spillover effects

**Digital spillovers:** indirect +/− consequences, also called externalities, of DT diffusion among firms and other market actors

## Positive digital spillovers

**Positive digital spillovers** are inherent to DTs being network goods and GPTs:

- **Network effects**: densified and accelerated interactions between adopters.
- **Digital knowledge spillovers:** sharing of good practices, processes, and innovations related to DTs within and across industries

## Negative digital spillovers

**Negative digital spillovers** can arise if DT diffusion among other firms translate into:

- **greater competition** within industries, and therefore revenue losses for firms with **limited technological absorptive capacity**.
- **structural change**, causing the decline of "old industries" made obsolete by new ICT-intensive industries

## Industrial & spatial spillovers

These +/ − spillovers can play **within industries**, or

… may be geographically bounded, through **agglomeration (dis)economies** (Duranton & Puga, 2004)

**The digital dividends from a greater diffusion of DTs are therefore likely but not granted**

# 2. Digital spillovers and African SMEs' performance: empirical evidence

# 2.1 Scope of analysis

## Research question

Recent studies have pointed out the positive impact of DT adoption on firm's output and employment (Hjort & poulsen, 2019; IMF, 2020),

...but **no studies investigate the consequences of their diffusion** within spaces and industries.

However, the low diffusion of DTs in SSA is a primary and systemic issue, with important consequences on industrial and spatial dynamics.

We hence estimate **the spillover effects of DTs (email, website, MM) diffusion** within industries and locations.

... on various indicators of **firm performance**: total revenue, labor productivity, exports, and workforce size.

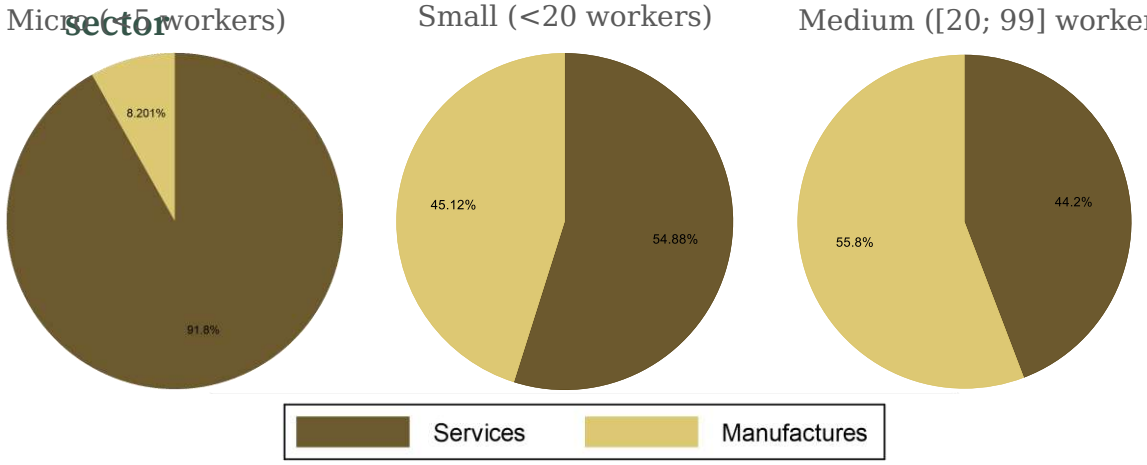
## Sample

27,436 micro, small and medium enterprises (< 99 FT workers) from 42 sub-Saharan African countries surveyed btw 2006-2018 (WBES).

Representative of the **formal, non-agricultural, and urban** African private sector

52% of SMEs operate in the service sector, 48% in the manufacturing sector

**Figure 2. SMEs' contribution to employment, by sector**




Source: Authors. Sample: 27,079 SMEs, 42 SSA countries, survey rounds covering 2006 to 2018. Probability sample weights applied.

# 2.2. Empirical framework

We follow (Paunov & Rollo, 2015, 2016) and build spillovers variables reflecting the penetration of **digital technologies'** in industry or location.

Concretely, we estimate the effect of:

- **Industry spillovers**: the incidence of each DTs within the firm's industry of operation (in%)
- **Location spillover**: the incidence of each DTs within the firm's location (in%)
- … irrespectively of firm i's technology adoption

… on firm's **sales**, **sales /worker**, **exports** and **number of full-time workers**

**Controlling for:**

- **DT adoption**, including email, website, and mobile money adoption binary variables.
- Various **firm-level characteristics**.
- **country-industry + location-year FE** when industry spillovers are estimated
- **country-industry-year + location FE** when location spillovers are estimated

**We proceed to OLS estimations of:**

Y=F(Spillovers; DT adoption; controls)

with standard-errors robust to heteroscedasticity and multi-way clustering

# 2.3. Results

## Industry spillovers

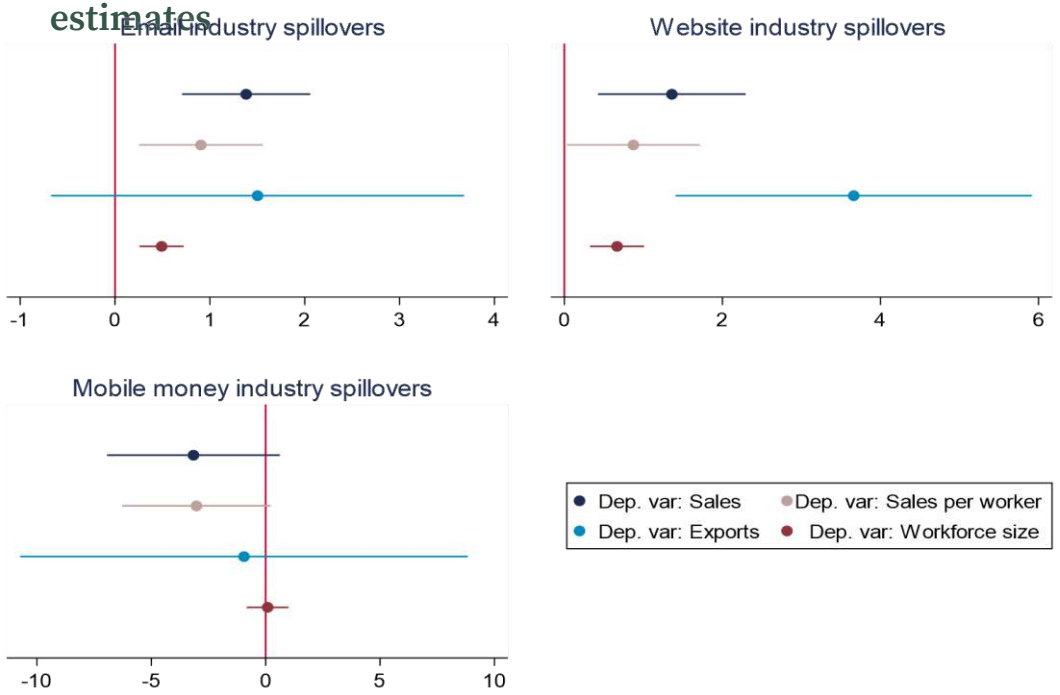
**+ industry spillovers** of Internet technologies' diffusion on firm's **total sales**, **sales/w**, and **workforce size**.

Strong **+ spillover effect of website** diff. on firm's **exports**

**− spillovers of mobile money** on firm's **sales** and **sales/w**.

Possible explanation: lack of absorptive capacity of this relatively new technology + delayed benefits of its diffusion among firms (Marsh et al. 2017)

**Figure 6. Industry spillovers of DTs diffusion, OLS estimates**




Standard errors are robust to heteroscedasticity and clustered by country-year-industry. Sample email/website spillovers: from 14,762 SMEs (sales per worker) to 16,548 SMEs (workforce size). Sample mobile money spillovers: from 2,854 SMEs (sales per worker) to 3,390 SMEs (workforce size).

# 2.3. Results

## Spatial spillovers

**Mixed evidence**:

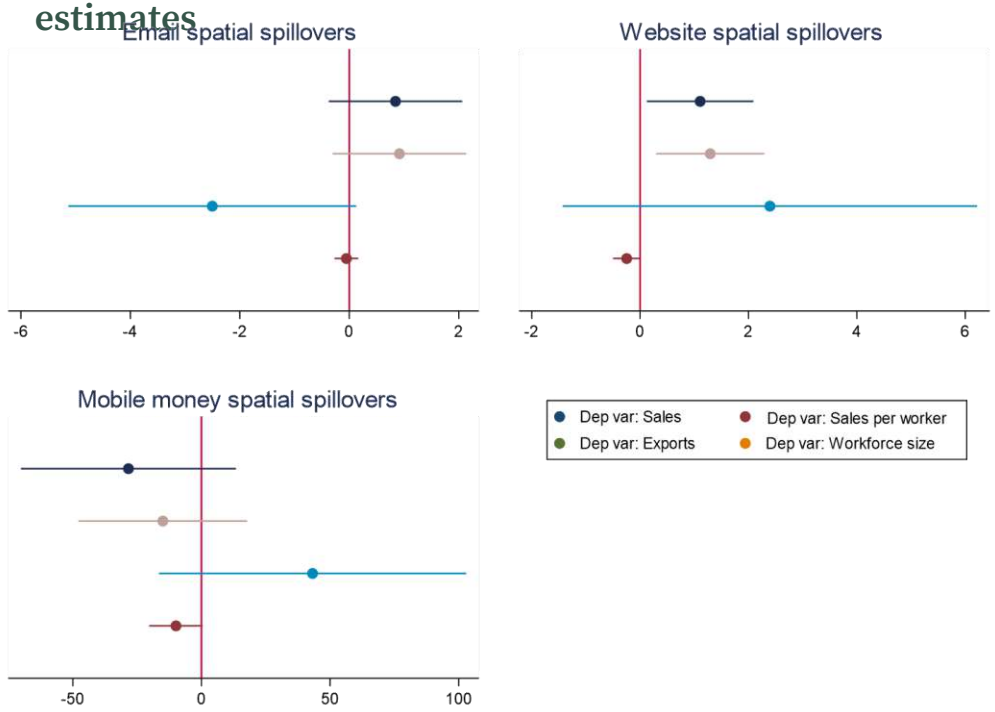
**+ spillovers** of emails and website diff. on **sales** and **sales/w**

**− spillovers** of email on **exports**

**− spillovers** of website and mobile money on **employment**.

Low diffusion of DTs among SMEs: **A critical mass of DT adopters in location/industry** might be necessary for + spillovers to prevail (Grace et al, 2004).

**Figure 7. Location spillovers of DTs diffusion, OLS estimates**




Standard errors are robust to heteroscedasticity and clustered by country-year-location. Sample (email/website spillovers): from 14,762 SMEs (sales per worker) to 16,548 SMEs (workforce size). Sample (mobile money spillovers): from 2,854 SMEs (sales per worker) to 3,390 SMEs (workforce size).

# 2.3. Results

## Threshold spillovers effects

To investigate the possibility of threshold in spillover effects, we introduce in the performance equation **the squared term of DTs incidence variables**

**Internet technologies**

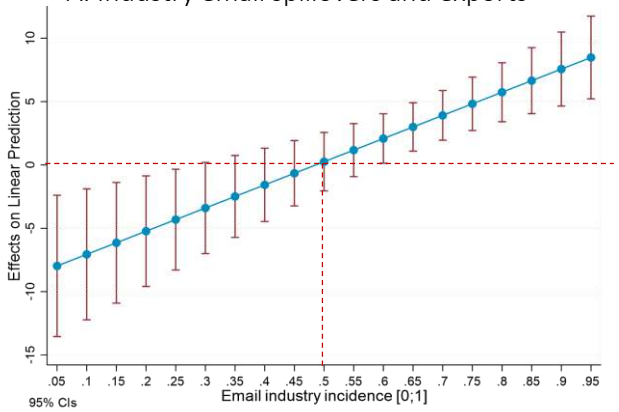
**U-shaped industry spillovers** of email diffusion on exports. Est threshold ≈ 50% incidence

**U-shaped spatial spillovers** of email diffusion on sales and labor productivity. Est threshold ≈ 50%

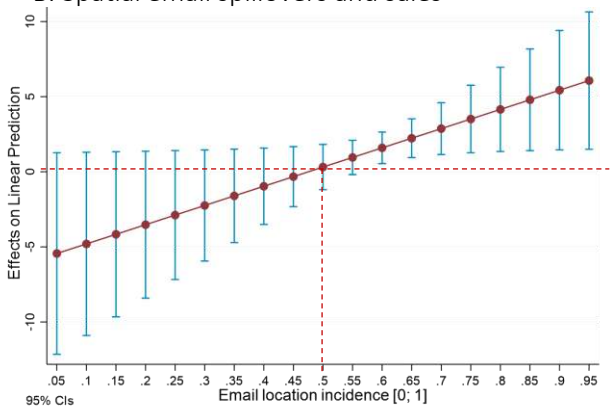
*[Threshold (≈10%) in the + spatial spillovers of website diffusion on exports and permanent workers (not reported)]*

**Figure 9. Location spillovers of DTs diffusion, OLS estimates**

A. Industry email spillovers and exports

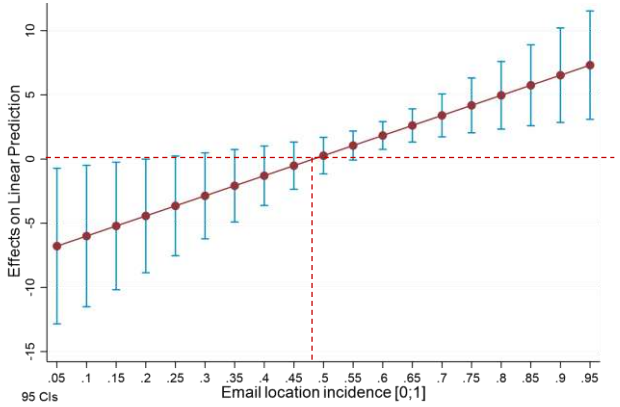



B. Spatial email spillovers and sales




Standard errors are robust to heteroscedasticity, clustered by country-year-industry in graph A/B, country-year-location in graph C.

C. Spatial email spillovers and sales per workers




**In sum, the low spatial and industrial diffusion of digital technologies is a strong impediment for African SMEs to exploit the potential of digitization.**

# 3. Advancing digital frontiers : digital initiatives rollout in West Africa

# 3.1 Digital innovation rollout in West Africa

The numbers previously presented only partially mirror the reality of digital transformations bourgeoning within the subcontinent's private sector.

### eCommerce - Jumia

- Online marketplace (app)
- Logistics (delivery) arm
- Payments through mobile money and airtime
- Other integrated mobile services

### Logistics – Kobo360

- Mobile app connecting truck drivers/owners and cargo senders/receivers
- Blockchain-enabled value chain management technology

### Employment - Lynk

- Mobile app linking service providers with potential clients
- Mobile money-integrated payment system
- Possibility for service providers and clients to rate each other

### Medical Logistics - Zipline

- Storage and delivery of blood and medications by drone
- Drone manufacturing, installation of launching and landing systems, construction of regional depots

### eInsurance - WorldCover

- Weather-indexed crop insurance through mobile technology and weather sensors
- Direct payment through mobile
- Blockchain → highly secure

### Electricity - Lumos

- Home solar system with integrated SIM card Payment through mobile money / airtime
- Pay-as-you-go rent-to-own model

### Agriculture - Investiv Group

- Field diagnostics by drone→ optimization of agricultural inputs
- Spraying (pest/disease control) and aerial mapping for certification programs through drones

### Tax Payment - Sudpay

- Tax monitoring and payments app for municipalities in Senegal
- Fintech and other mobile money financial services offered as an incentive for take-up

### Potable Water - CityTaps

- Prepaid smart water meters
- Mobile money payment system
- Cloud-based data storage to facilitate monitoring
- Pay-as-you-go model

# 3.1 Digital innovation rollout in West Africa

## Impacts

- **29 million products** displayed on Jumia's eCommerce market (impact analysis underway)
- **>25,500 jobs completed** on Lynk platform between 2016 and 2018
- **>30,000 farmers insured** in 3 countries by WorldCover
- **760 million kg of cargo** transported through Kobo360 between 2017 and 2020 (200 billion USD, 17,000 drivers)
- Zipline delivered **medical supplies to over 500 health centers** from a single distribution center in Ghana
- **8,000 ha of fields diagnosed** (Investiv Group)
- **100,000 solar systems** installed in Nigeria and **1,100 jobs** created (Lumos).
- Townpay application **collects 40,000 USD per month in taxes**
- CityTaps clients reported significant **reduction in money and time costs** for water collection

## Challenges

- Complicated **regulatory environments** (e.g. regulations related to usage of drones in public air space in Côte d'Ivoire)
- International **commerce restrictions**; e.g. Covid-19 (ex. logistics, Kobo360)
- High **fixed costs** (ex. drones for agriculture, Investiv Group)
- Difficulties **accessing investment funds** (ex. CityTaps)
- Lack of **familiarity with product or technology** (ex. crop insurance, WorldCover)
- Lack of taxpayer **incentive to adopt new digital public service platform** (ex. mobile tax payments, Sudpay)

# Lessons learned and implications for future interventions' design

Beyond the direct dividends of digital technologies adoption by SMEs, their diffusion across space and industries **may have not yet reached the critical mass of users to unleash their full potential**.

Subsequent risk that digitization **benefits first-movers, large and productive firms** with sufficient absorptive capacity**, at the expense of more fragile firms and ecosystems**, thereby concomitantly provoking **revenue losses, job destruction, or firm exits**.

The impact of digital technologies diffusion could be much **larger if the digital divide within industries and locations were lower**, and if the **technology absorption capacity of firms were greater**.

# Lessons learned and implications for future interventions' design

Our analysis gives additional support to key areas of intervention identified by development institutions and agencies:

- ensuring that the regulatory framework in the telecommunications and banking sectors is conducive to **sustained investments in digital (broadband) infrastructures**,
- reinforcing **basic literacy and numeracy skills**, developing **digital skills**
- promoting **digital entrepreneurship** through improved access to funding and capacity building
- and **extending social protection coverage to protect the potential "losers" of the digitization process**.

# Thanks for your attention!