

Making SupTech Work: Evidence on the Key Drivers of Adoption

Leonardo Gambacorta¹, Nico Lauridsen²,
Samir Kiuhan-Vásquez² & Jermy Prenio¹

¹Bank of International Settlements ²European University Institute (EUI)

Sunday 17th May, 2026

1. Introduction
2. Analytical Framework
3. Data & Variables
4. Empirical Strategy
5. Results
6. Conclusions & Policy Implications

- Financial supervision mitigates market failures: asymmetric information, moral hazard, agency conflicts (*Pigou, 1932; Akerlof, 1970; Jensen & Meckling, 1976; Stiglitz & Weiss, 1981*).
- Supervisory effectiveness depends on the cost, precision, and timeliness of information production (Llewellyn, 1999).
- Rapid digitalisation has altered this production function:
 - Granular, high-frequency data from financial institutions.
 - New risk domains: cyber, digital assets, climate.
 - Traditional tools struggle to process these data flows.

Research Questions

What determines the technological capacity of financial supervision?

Which institutional, technological, and organisational mechanisms drive suptech adoption?

- **SupTech**: the use of innovative technologies by supervisors to improve market monitoring, data collection, and risk detection (*Broeders & Prenio, 2018*).
- Adoption has been slow and uneven – yet only a few have made suptech truly integral to supervisory processes (*Prenio, 2024*).
- Key barriers include:
 - Legacy IT systems and data constraints
 - Limited resources and skills gaps
 - Difficulty aligning technology projects with supervisory objectives and risk frameworks
- Adoption of SupTech is not only technical, but **organisational and strategic**.
- This paper provides the **first systematic cross-country evidence** on the determinants of suptech adoption.

Contributions

- Novel cross-country evidence on suptech adoption determinants.
- Analysis of the suptech life cycle (PoC → WP → DP)
- Links organisational structure, strategic frameworks, and enabling technology to deployment outcomes.
- Foundation for future research on suptech's impact on financial stability (*Goldstein, 2025*).

Main Findings

- Dedicated SupTech unit = strongest predictor of deployment.
- Integrated strategies $\approx$ **+20 deployed tools**.
- Public cloud significantly boosts AI-based implementation.
- In-house development drives early AI experimentation.

Financial Supervision

Supervision reduces fragility
(*Bassett et al., 2015*)

Enforcement enhances stability
(*Delis et al., 2019*)

Resources scale with bank size
(*Eisenbach et al., 2022*)

SupTech tightens credit to riskier
firms (*Degryse et al., 2025*)

Technology Adoption

AI enhances supervisory workflows
(*Brynjolfsson & Kazinnik, 2025*)

SupTech tools for AML (*Coelho et al., 2019*)

Alt-data in supervision
(*Alonso-Robisco et al., 2025*)

Cloud as enabling infrastructure
(*Araujo et al., 2025*)

Institutional Capacity

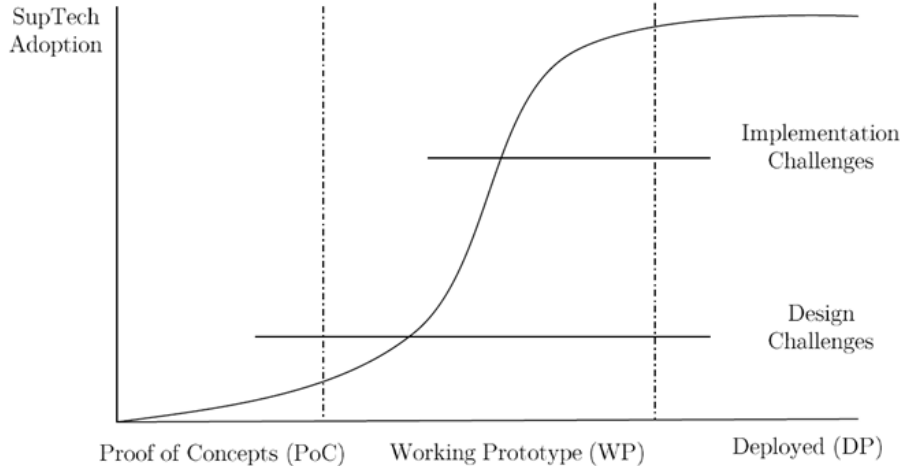
Architecture affects effectiveness
(*Masciandaro et al., 2008*)

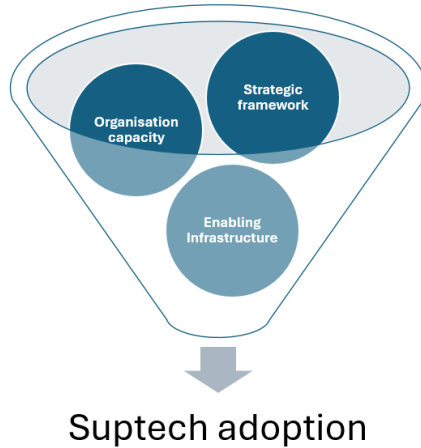
Independence & accountability
(*Dincer & Eichengreen, 2012*)

Capacity building (*Crisanto et al., 2022*)

SupTech strategy & deployment
(*Prenio, 2024*)

SupTech Lifecycle





Three Interdependent Strategic Pillars

1. Digital Transformation Strategy

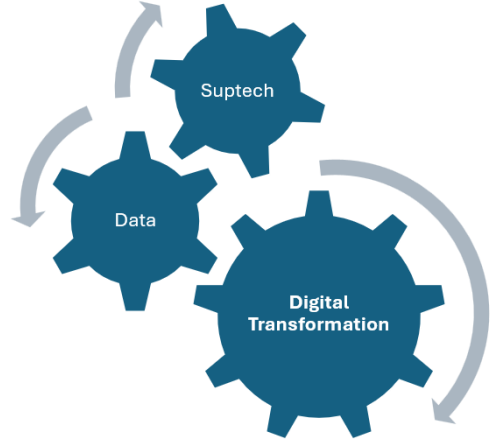
Umbrella framework modernising operations, infrastructure, and workforce; fosters agility in response to evolving market conditions.

2. Data Governance Strategy

Establishes protocols for data management, quality, security, and ethical use; supports AI-readiness through robust architecture and interoperability.

3. SupTech Strategy

Structured plan covering experimentation, development, and deployment; integrates tools into existing supervisory systems (*Prenio, 2024*).



- **Source:** 2024 State of SupTech Survey (Cambridge SupTech Lab & DTS).
- **Sample:** 112 authorities across 97 countries and 6 continents (after merging with IMF indices).
- **Scope:** 56-question survey covering strategies, applications, organisational models, challenges, and enabling technologies.
- **Coverage:** $\approx 67\%$ from EMDEs.
- **Merged with:** IMF Financial Development indices (*Svirydzenka, 2016*) – depth, access, efficiency sub-indices for financial institutions and markets.

Sample Composition

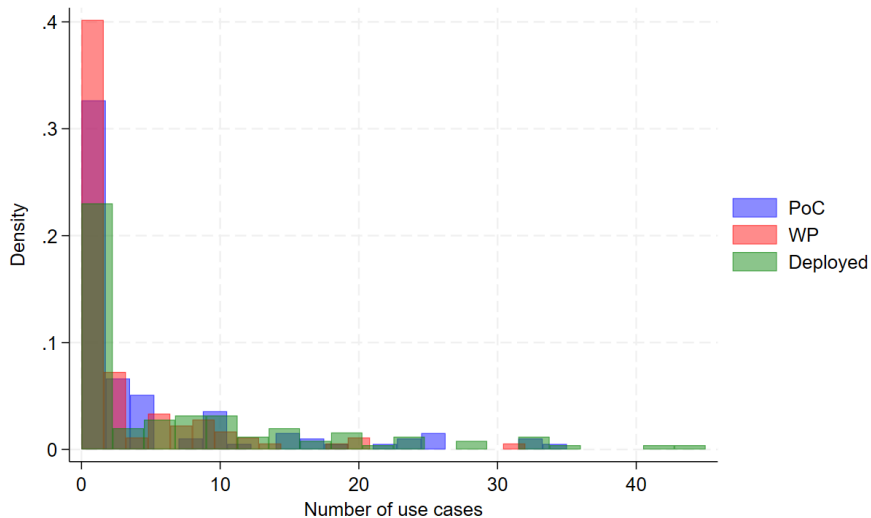
By authority type

49.1% Standalone Banking Supervisors
30.4% Central Banks
20.5% Other Supervisory Authorities

By region (World Bank)

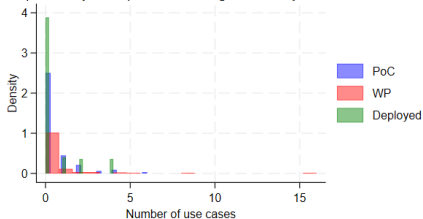
30.4% LAC 29.5% ECA
EAP, MENA, SA, SSA (smaller)
3.6% North America

Distribution of SupTech Activity – All Use Cases

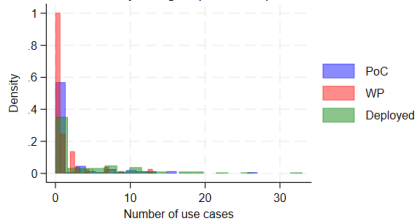


Distribution across Supervisory Categories

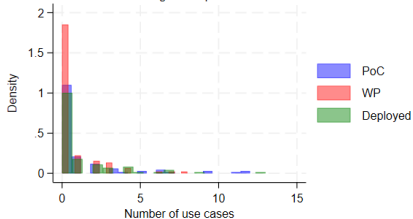
Suptech life cycle - Supervision & oversight of relatively new risks



Financial stability oversight & prudential supervision



Licensing & Compliance



Suptech adoption Consumer protection & conduct supervision

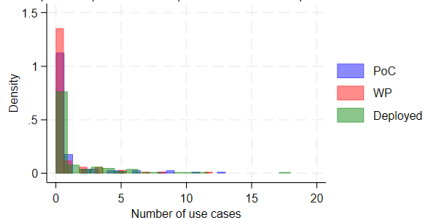


Table 1: Summary Statistics

Variable	Obs.	Mean	Std.Dev.	Min	Max
Proof-of-Concept	112	4.652	8.035	0	35
Working Prototype	112	2.795	5.166	0	32
Deployed Solution	112	6.929	10.029	0	45
Size (In employees)	112	5.818	1.288	3.401	9.903
SupTech Unit	112	0.509	0.502	0	1
Data Governance	112	0.348	0.479	0	1
Digital Transformation	112	0.339	0.476	0	1
SupTech	112	0.259	0.440	0	1
Total Challenges	112	7.830	4.640	0	20
Design	112	3.205	2.019	0	9
Implementation	112	4.625	2.774	0	12
Public Cloud	45	0.111	0.318	0	1
Private Cloud	45	0.400	0.495	0	1
Hybrid Cloud	45	0.200	0.405	0	1
AI	76	0.408	0.495	0	1
AI early-stage	76	0.342	0.478	0	1
AI deployed	76	0.066	0.250	0	1

Empirical Strategy – Why a Hurdle Model?

Data challenges

- *Excess zeros*: many authorities report no suptech activity – structural non-adoption, not just low counts.
- *Overdispersion*: among adopters, variance far exceeds the mean (DP: mean = 6.9, SD = 10.0, max = 45).
- Standard Poisson or NB models conflate the two decisions, yielding biased estimates.
- A hurdle model disentangles:
 - *Whether* to adopt at all.
 - *How many* tools, given adoption.

Hurdle Model Framework (*Cragg, 1971; Mullahy, 1986*)

Stage 1 – Binary logit

Probability of crossing the hurdle (any adoption vs. none)

Stage 2 – Zero-truncated NB

Intensity of adoption, conditional on $Y_i^s > 0$

Challenges: Poisson model

AI & cloud: Linear Prob. Model

The Hurdle Model – Formal Specification

- Let $Y_{is} \in \{0, 1, \dots, 104\}$ be the number of suptech areas where authority i has a project at stage $s \in \{\text{PoC}, \text{WP}, \text{DP}\}$.
- The outcome distribution decomposes as:

$$\Pr(Y_i^s = y) = \begin{cases} \pi_i^s, & y = 0 \\ (1 - \pi_i^s) \cdot \frac{f(y; \mu_i^s, \alpha^s)}{1 - f(0; \mu_i^s, \alpha^s)}, & y > 0 \end{cases} \quad (1)$$

π_i^s = probability of structural zero

$f(y; \mu_i^s, \alpha^s)$ = negative binomial PMF

$\mu_i^s = \exp(Z_i \gamma^s)$ = expected count

α^s = overdispersion parameter

Advantage

Greater flexibility in capturing excess zeros and the conditional distribution of non-zero counts
(Gurmu, 1999; Feng, 2021).

Hurdle Model – Step 1: Binary Logit

- Estimates the probability that authority i undertakes *any* suptech project at stage s :

$$\Pr(Y_{is} > 0) = \frac{\exp(X_i\beta_s)}{1 + \exp(X_i\beta_s)} \quad (2)$$

- Specification – identical across all stages, exogenous variables only:

$$Y_{i,c}^{0,1} = g_1 \text{Size}_i + g_2 \text{AuthorityType}_i + g_3 \text{Region}_c + g_4 \text{IMF Indices}_c + \varepsilon_{i,c} \quad (3)$$

Size: $\ln(\text{employees})$

AuthorityType: standalone supervisor, other agency; *central bank* = *reference*

Region: World Bank dummies (MENA, ECA, LAC, SA, SSA, NA); *EAP* = *reference*

IMF Indices: financial development – depth, access, efficiency

Hurdle Model – Step 2: Zero-Truncated Negative Binomial

- Estimates the number of tools adopted, conditional on $Y_{is} > 0$, augmenting Step 1 with suptech-specific organisational variables:

$$Y_{i,c}^s = r_1 \text{Size}_i + r_2 \text{AuthType}_i + r_3 \text{Strategies}_i + r_4 \text{Organisation}_i + r_5 \text{SupTechUnit}_i + r_6 \text{EconDev}_c + r_7 \text{Region}_c + r_8 \text{IMF Indices}_c + \varepsilon_{i,c} \quad (4)$$

Organisation: decentralised (*ref.*), centralised hub, hub-and-spoke, other

SupTechUnit: dummy = 1 if dedicated unit exists

Strategies: dummies for SupTech (SS), Data Governance (DG), Digital Transformation (DT); pairwise and triple interactions

EconDev: advanced vs. developing economy

Challenges (Table 3, cols. 4–6)

Dependent variable: count of design and implementation challenges reported.

Model: Poisson count model (second step only; distribution not markedly zero-inflated).

Key regressors: stage dummies (PoC/WP/DP) = 1 if above sample mean; strategic framework dummies and interactions.

AI & Cloud (Table 4)

Model: Linear Probability Model

$$\Pr(Y_i = 1 \mid X_i) = X_i' \beta + \varepsilon_i$$

Dependent variables:

- (i) any AI adoption (early stage to deployed)
- (ii) early-stage AI only

Key regressors:

Cloud type: private / public / hybrid

Sourcing: in-house / external / hybrid

Authority controls + regional FE

Results Table 2: Baseline Hurdle Model

Variables	Panel A: PoC		Panel B: WP		Panel C: DP	
	(1) Logit	(2) Count	(3) Logit	(4) Count	(5) Logit	(6) Count
Size	0.042 (0.051)	-0.559 (1.038)	0.087 * (0.046)	1.189 (0.753)	-0.007 (0.048)	0.076 (1.170)
Other Sup. Auth.	-0.054 (0.121)	-3.004 (2.247)	0.103 (0.118)	0.886 (1.363)	0.123 (0.122)	1.517 (2.481)
Standalone Banking	0.216 (0.135)	3.288 (3.355)	0.247 * (0.134)	2.744 (1.976)	0.234 * (0.132)	4.517 (3.555)
SupTech Unit	-	3.803** (1.857)	-	0.899 (0.896)	-	6.526*** (2.039)
Regional & IMF controls	Yes	Yes	Yes	Yes	Yes	Yes
Org. models control	No	Yes	No	Yes	No	Yes
Econ. dev. control	No	Yes	No	Yes	No	Yes
Observations	112	112	112	112	112	112
Pseudo R2	0.165	0.165	0.199	0.199	0.128	0.128

Authority Size & Type

- Size predicts *initiation* across all stages (logit step) but not the count conditional on adoption.
- Standalone banking supervisors more active across the full lifecycle vs. central banks: no competition with non-supervisory mandates; more flexibility and fewer procurement constraints.

Organisational Structure

- Hub & Spoke $\Rightarrow$ significantly fewer PoC projects vs. decentralised approach.
- **Dedicated SupTech unit** is the crucial driver:
 - +3.8 PoC tools on average.
 - +6.5 deployed tools on average.
- Formal allocation of resources and expertise is the strongest enabler for deployment.

Results Table 3: Role of Strategies

Variables	Panel A: SupTech Lifecycle			Panel B: Challenges		
	(1) PoC	(2) WP	(3) DP	(4) All	(5) Design	(6) Implement.
Data Gov. (DG)	3.340 (3.264)	0.292 (1.532)	−8.119 *** (3.092)	−0.092 (0.195)	−0.081 (0.188)	−0.099 (0.207)
SupTech Strat. (SS)	6.947 * (4.066)	−1.418 (2.098)	−8.329 * (4.789)	0.132 (0.176)	0.348 * (0.206)	−0.019 (0.178)
Digital Trans. (DT)	2.009 (2.961)	−0.559 (1.308)	−9.439 * (5.445)	−0.082 (0.203)	−0.003 (0.249)	−0.136 (0.182)
DG × SS	−9.026 (6.414)	−0.246 (2.260)	15.417 *** (5.939)	0.205 (0.325)	0.003 (0.330)	0.346 (0.342)
DG × DT	−8.706 * (5.075)	−3.127 (2.784)	16.441 ** (7.064)	0.519 (0.328)	0.428 (0.363)	0.580 * (0.324)
SS × DT	−11.787 * (6.122)	−0.359 (2.701)	16.994 ** (7.491)	0.232 (0.369)	−0.006 (0.383)	0.395 (0.381)
DT×SS×DG	−13.350* (7.011)	−0.675 (2.630)	24.290*** (8.186)	−1.430** (0.557)	−1.159** (0.566)	−1.617*** (0.582)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	112	112	112	112	112
Pseudo R^2	0.187	0.221	0.155	0.100	0.084	0.105

Individual Strategies

- SupTech strategy alone: boosts PoC (+7.3) but *reduces* deployed tools – confirms focus on experimentation over deployment (*Prenio, 2024*).
- No individual strategy significantly explains WP variation.
- Each strategy in isolation is insufficient for scaling.

Combined Strategies – Main Result

- Triple interaction $DT \times SS \times DG$:
 - +22.7 deployed tools ($p < 0.01$).
 - ≈ 20 additional tools on average.
 - -1.4 total challenges.
 - -1.6 implementation challenges.
- Large-scale deployment requires a comprehensive integrated approach combining data, technology, and institutional transformation.

Results - AI & Cloud Adoption

Table 4.a: The Effect of Cloud on AI Adoption

Variables	Panel A: AI Models			Panel B: Cloud Models		
	(1) AI	(2) AI early	(3) AI dep.	(4) AI	(5) AI early	(6) AI dep.
SupTech Unit	0.256,2** (0.1141)	0.182,0 (0.1122)	0.074,1 (0.0550)	0.084,4 (0.2005)	0.131,8 (0.2308)	-0.047,4 (0.0938)
Size	0.053,3 (0.0673)	-0.024,3 (0.0666)	0.077,6* (0.0418)	0.081,6 (0.0945)	-0.066,7 (0.1237)	0.148,3* (0.0763)
Public Cloud				0.4685* (0.2527)	0.1741 (0.3008)	0.2944* (0.1446)
Private Cloud				0.060,1 (0.1728)	-0.008,8 (0.1949)	0.068,9 (0.1087)
Hybrid Cloud				0.299,8 (0.1942)	0.176,7 (0.2614)	0.123,1 (0.1447)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	76	76	76	45	45	45
R^2	0.420	0.361	0.320	0.607	0.380	0.587

Results: AI & Cloud Adoption

Table 4: Panel C: Sourcing Models

Variables	Panel C: Sourcing Models		
	(7) AI	(8) AI early	(9) AI dep.
SupTech Unit	0.078,1 (0.2215)	−0.050,8 (0.2065)	0.128,9 (0.1006)
Size	0.104,0 (0.0956)	−0.165,2 (0.1147)	0.269,2** (0.1067)
Sourcing: Hybrid	−0.192,0 (0.1445)	−0.330,3* (0.1733)	0.138,3 (0.1284)
Sourcing: External	−0.6184** (0.2348)	−0.7571*** (0.2359)	0.1387 (0.1473)
Controls	Yes	Yes	Yes
Observations	36	36	36
R^2	0.534	0.606	0.600

Cloud Infrastructure

- Public cloud: +46.9% probability of AI suptech (any stage) vs. no cloud.
- Still significant for full deployment: +29.4%.
- Scalable compute and storage that authorities cannot easily own independently.
- SupTech unit also a significant predictor of AI adoption.

Sourcing Model

- External-only sourcing:
 - –61.8% probability of any AI adoption.
 - –75.1% probability of early-stage AI.
- Reflects “black box” nature of proprietary AI tools and limited vendor transparency.
- In-house development drives early AI experimentation; authority size matters more for full deployment.

Results Summary

- (i) Authority size predicts initiation; standalone mandate boosts activity across the full lifecycle.
- (ii) Dedicated SupTech unit is the single strongest predictor of deployment intensity (+6.5 tools on average).
- (iii) SupTech strategy alone favours experimentation over deployment.
- (iv) All three strategies combined $\Rightarrow \approx 20$ additional deployed tools and fewer challenges.
- (v) Public cloud significantly boosts AI deployment probability.
- (vi) In-house development drives early AI experimentation; external-only sourcing strongly impedes adoption.
- (vii) Deployment lags in emerging risk areas (climate, cyber, digital assets).

Organisation & mandate drive early adoption

Strategy & technology drive deployment depth

Conclusion & Policy Implications

- First systematic cross-country evidence on the determinants of suptech adoption across **112 financial authorities**.
- SupTech is not a discrete IT investment but part of a broader **organisational transformation**; success requires aligning strategy, organisational design, and infrastructure.
- **Policy implications:**
 - Embed suptech within an integrated strategy spanning data governance, digital transformation, and suptech to maximise deployment and minimise challenges.
 - Establish dedicated suptech units to translate strategic intent into operational capacity.
 - Invest in cloud infrastructure – especially public/hybrid – as the key enabler for AI-based tools.
 - Prioritise in-house capacity; vendor lock-in impedes adoption.
- **Future research:** micro-level impacts on enforcement outcomes and risk-taking behaviour (*Goldstein, 2025*).

Thank You

Questions & Comments Welcome

nico.lauridsen@eui.eu