Supplementary Materials for

The paradox of faster learning and slower cost reduction as technologies mature

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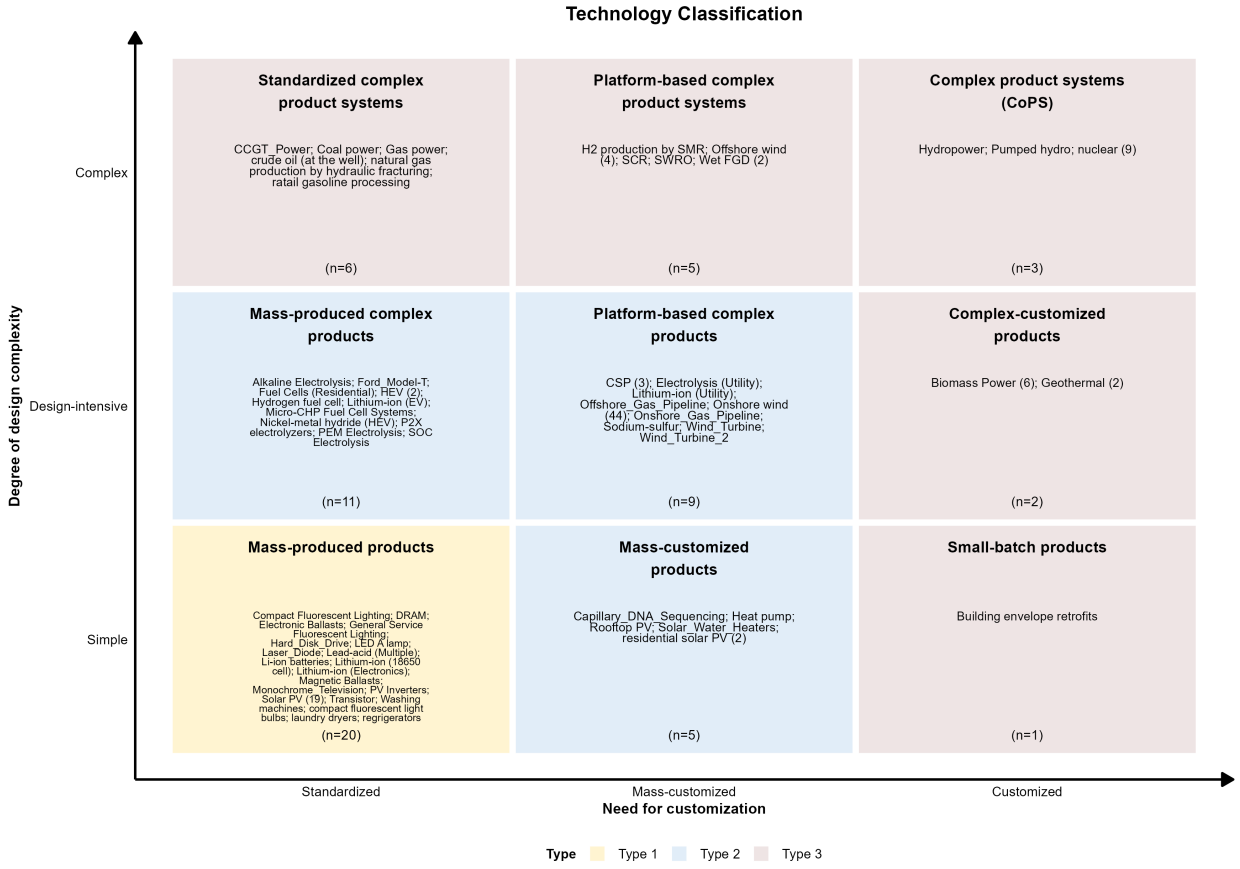
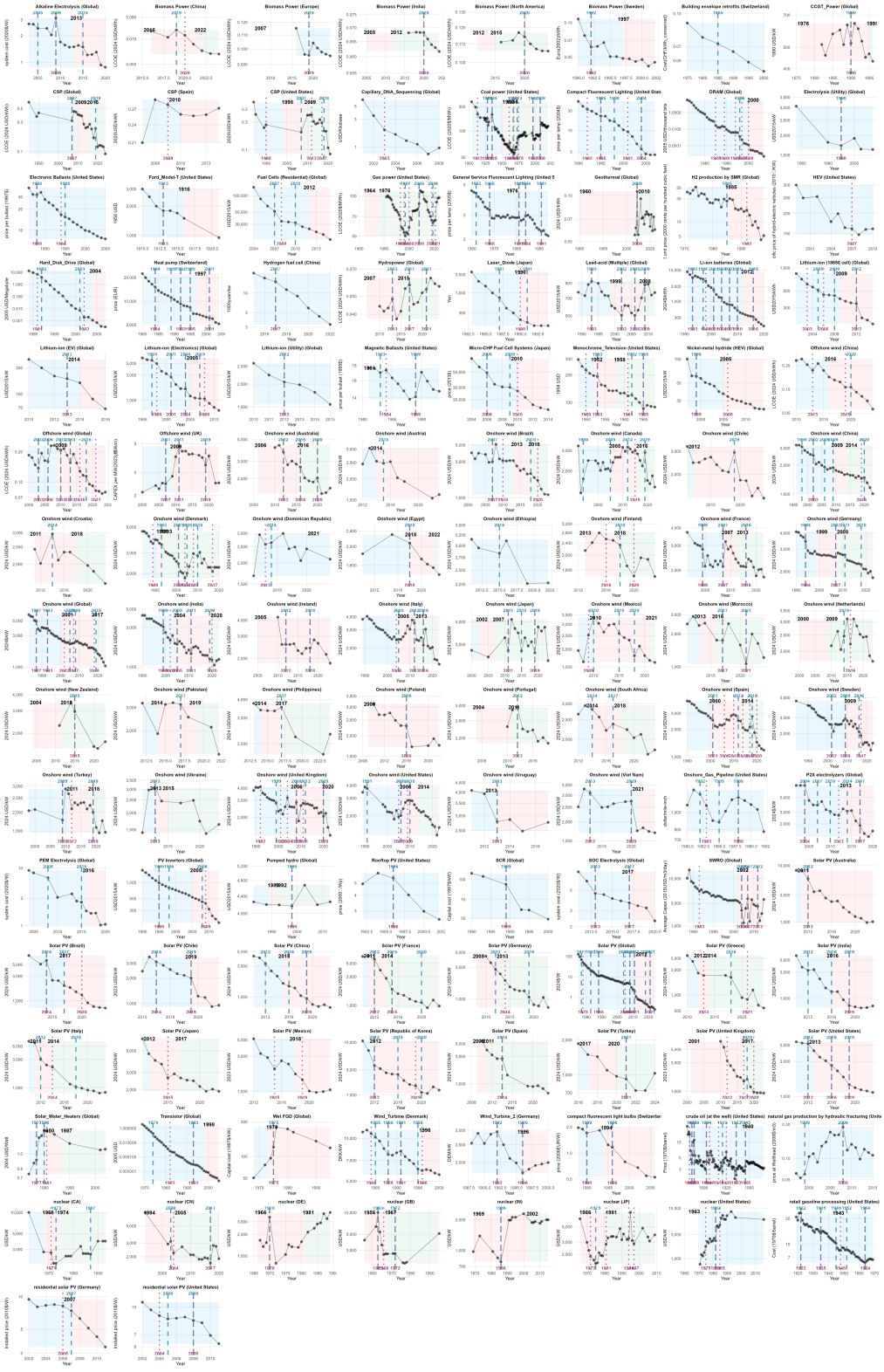
Supplementary Figures

Supplementary Fig. 1 | Technology classification of the final full sample.
Technologies are classified by degree of design complexity and need for customization, following Malhotra and Schmidt. Colors indicate the three technology types. The plot covers the final full sample used in this study, including both global and national/regional technology-region series. The notation "(n=)" in each cell denotes the number of unique technologies assigned to that category. The number in parentheses following a technology name is shown only when that technology is represented by multiple regional series and indicates the number of regions represented.

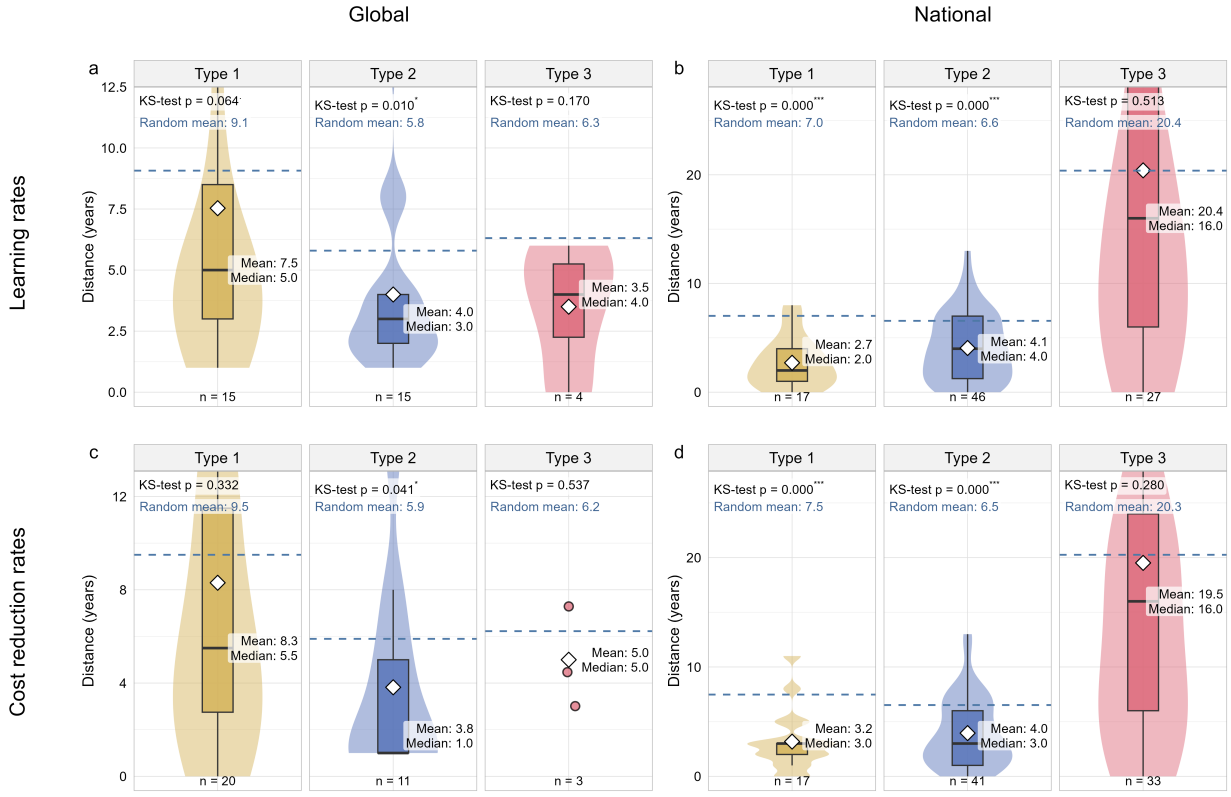


Supplementary Fig. 2 | Breakpoint detection results (h = 3/n).
Individual technology-region trajectories with detected learning rate breakpoints and cost reduction rate breakpoints, using a minimum segment size of h = 3/n. Shaded bands indicate technology growth phases. Only series with at least one detected breakpoint are included in the overview.

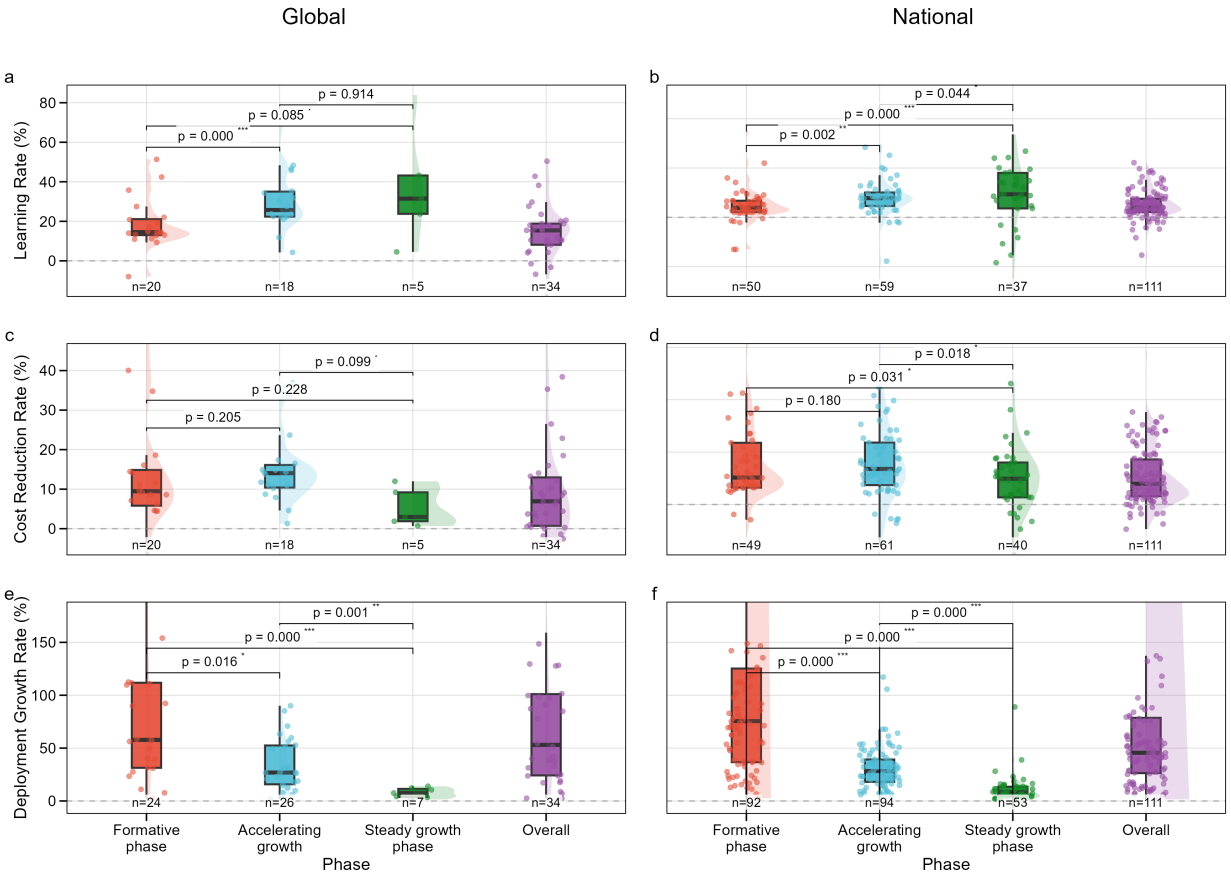


Supplementary Fig. 3 | Breakpoint detection results (h = 5/n).
Individual technology-region trajectories with detected learning rate breakpoints and cost reduction rate breakpoints, using a minimum segment size of h = 5/n. Shaded bands indicate technology growth phases. Only series with at least one detected breakpoint are included in the overview.

Supplementary Fig. 4 | Distances between breakpoints and technology growth phase transitions (h = 5/n). Distance from each observed breakpoint to the nearest deployment phase transition for learning rates (**a, b**) and cost-reduction rates (**c, d**) in the global and national samples, across technology Types 1–3. Dark black line indicates median, diamonds indicate means, box indicates IQR. Violins show kernel density estimates of the empirical distance distributions for each technology type. Dashed blue lines mark the mean distance for the randomly simulated nulls (Methods). The Kolmogorov–Smirnov (KS) test compares the distributions of empirical observations and random simulations ($^{\cdot}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Breakpoints use a minimum segment width of h = 5/n (≥ 5 data points per segment).

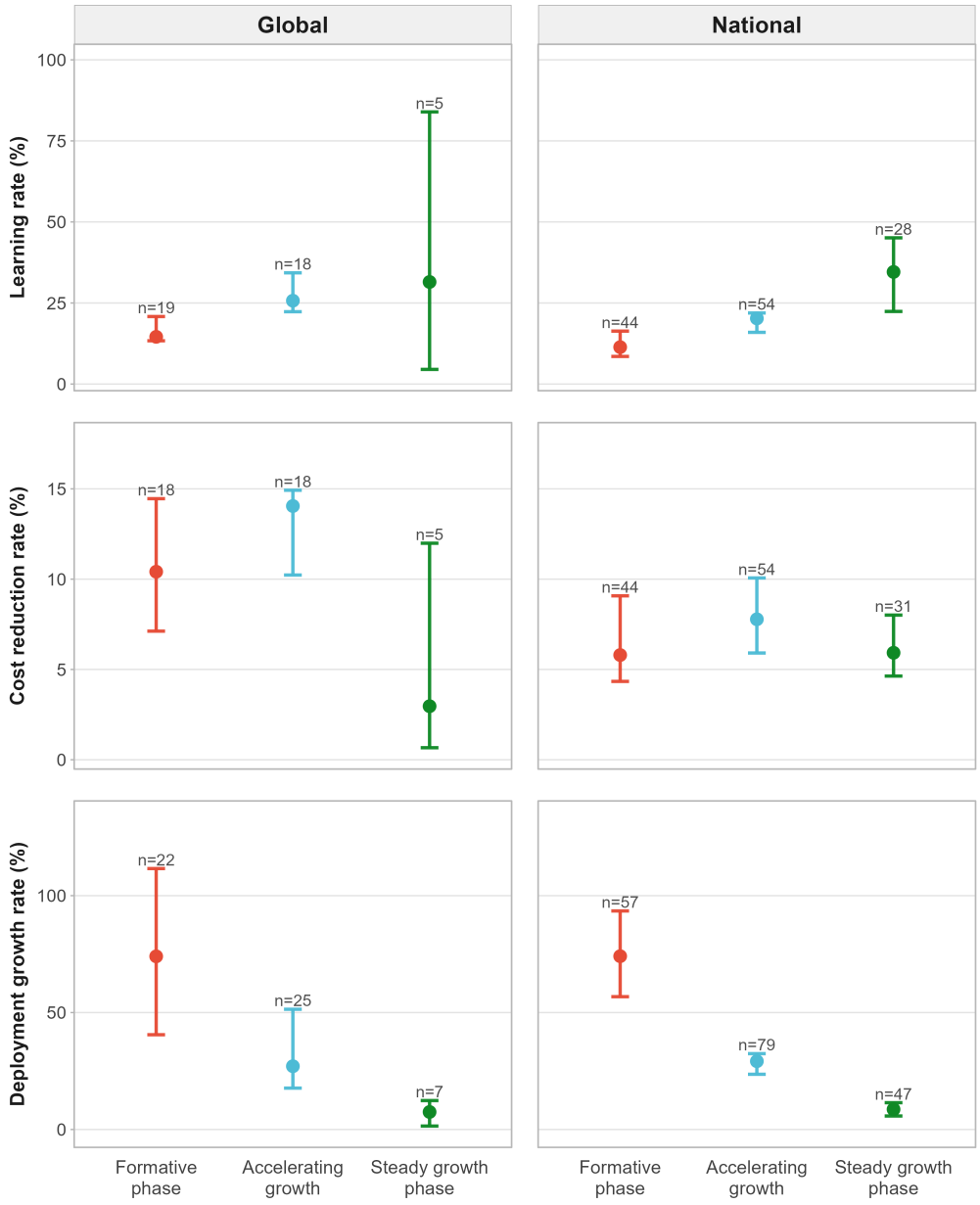


Supplementary Fig. 5 | Learning rates, cost reduction rates, and deployment year-on-year growth rates over the phases of technology growth with full range.
Learning rates (**a, b**), cost-reduction rates (**c, d**), and year-on-year deployment growth rates (**e, f**), for the global (**a, c, e**) and national (**b, d, f**) samples. Distributions are grouped by formative (red), accelerating growth (blue), and steady growth phases (purple), with overall, pooled distributions included for reference. Right-sided half-violins show kernel density estimates of the distributions for each growth phase. Pairwise comparisons between development-phase distributions were made using two-sample Kolmogorov–Smirnov tests (˙ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).



Supplementary Fig. 6 | Bootstrap confidence intervals for phase medians.

Point-range plots show phase-level median learning rate, cost reduction rate and deployment growth rate for the global and national samples. Error bars show 95% confidence intervals from a technology-level clustered bootstrap with 10,000 iterations.



Supplementary Tables

Supplementary Table 1 | Descriptions and sources for technology data

Provided in the attachment csv file.

Supplementary Table 2 | Within-technology paired comparisons of learning and cost reduction rates.

Sample	Increase in LR from formative to accelerating	Increase in LR from accelerating to steady growth	Increase in CRR from formative to accelerating	Increase in CRR from accelerating to steady growth
Full	71% (35/49)	59% (10/17)	49% (25/51)	32% (6/19)
Global	82% (14/17)	100% (2/2)	53% (9/17)	100% (2/2)
National	66% (21/32)	53% (8/15)	47% (16/34)	24% (4/17)