



TRANSITIONS LAB • PRIMER

Reading a Transition

A plain-language primer on how technologies actually change the world: what a socio-technical transition is, why good technologies fail, and how to read one.

START HERE

How to use this resource

This primer explains, in plain language, how technologies actually spread or fail in the real world. It is the conceptual foundation beneath everything the Lab does. If you have ever wondered why a clearly better technology did not win, or why the same product succeeds in one place and fails in another, this explains the machinery behind that.

What this is

A working reference, not a marketing brochure. Read it in order, or jump to the section you need using the contents opposite.

Who it is for

Anyone new to socio-technical thinking: innovators, funders, programme managers, and policymakers who work with technology but were not trained in transitions theory. It assumes no background.

How to get value from it

- 01** **Start with the core idea**
Section 1 makes the single most important move: seeing a technology as a system, not an object. Everything follows from it.
- 02** **Learn the three levels**
Section 2 gives you the Multi-Level Perspective, niche, regime, landscape, the standard map of how change happens. This is the vocabulary.
- 03** **See why good technologies fail**
Section 3 explains lock-in: why incumbents persist even when a better option exists. This is the problem the field exists to solve.
- 04** **Read the worked examples**
Section 4 walks through real cases, mobile money, electric mobility, so the abstractions become concrete.
- 05** **Take away the reading method**
Section 5 turns the theory into a practical way of looking at any transition you encounter.

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PRIMER · SECTION 1

A technology is never just a technology

The same device, dropped into two different contexts, produces two different outcomes. To predict either, you have to study the whole system, the technology and the people together.

This is the founding insight of socio-technical thinking. A technology is an artefact plus the people who use it, the institutions that govern it, the incentives around it, and the place it lands in. Studied in isolation, an artefact is illegible: it tells you almost nothing about what it will do. Studied in context, it becomes possible to understand, and sometimes to steer.

The field that studies this is sustainability transitions research, which emerged over the past two decades to explain how large socio-technical systems, energy, mobility, food, water, change over time (Markard et al., 2012; Köhler et al., 2019). Its central claim is simple and radical: technical change and social change are the same process, seen from two sides.

KEY POINT

The one idea to take away

A technology's effect is a property of the whole system it enters, not of the artefact. Change the technology alone and little may happen. Change how it meets people, institutions, and infrastructure, and everything can.

The artefact is one layer

Around any technology sit users with habits, institutions with rules, infrastructures it depends on, and a place with its own economics. These layers are what decide its fate.

Effects emerge from the whole

A payment app's effect is not in the software; it is in how the software meets a person's cash flow, a shopkeeper's trust, a regulator's rules. The effect belongs to the system.

SECTION 2

The three levels of change

The standard map of how socio-technical change happens is the Multi-Level Perspective (MLP), developed by Rip and Kemp (1998) and Geels (2002, 2004). It is the single most useful piece of vocabulary in the field. It sees change as an interaction between three levels.

Level	What it is	Example
Niche	A protected space where a radical innovation is developed, shielded from full market pressure.	An electric-motorcycle startup and its early riders.
Regime	The established, locked-in system that governs how a sector works: technology, rules, habits, infrastructure.	The petrol vehicle system: fuel stations, mechanics, financing, driver habits.
Landscape	Slow, broad pressures outside anyone's direct control that can destabilise the regime.	Climate change, oil-price shocks, demographic and cultural shifts.

Transitions happen when the three align. Landscape pressure (say, a climate imperative) destabilises the regime, opening a window; a niche innovation that is ready breaks through; and the regime reconfigures around it (Geels and Schot, 2007). Timing is everything: a niche that is not ready when the window opens misses it, and a window that never opens leaves even a strong niche stranded.

The Lab's work lives at the niche-regime interface, the boundary where a new technology actually meets the entrenched system. That is where adoption is won or lost, and where field research earns its value.

SECTION 3

Why good technologies fail

If a technology is clearly better, why does the old one persist? The answer is lock-in: the incumbent regime is held in place by self-reinforcing mechanisms that have nothing to do with which technology is best.

The concept begins with Arthur (1989), who showed that competing technologies with similar starting points can settle on entirely different outcomes depending on the sequence of small early choices, through increasing returns. Four mechanisms drive it: learning effects (the incumbent keeps improving because everyone uses it), economies of scale, network effects (it is valuable because others use it), and informational advantage. Unruh (2000) applied this to fossil-fuel energy as carbon lock-in: technologies, institutions, and behaviours co-evolve into a stable complex that resists change even when the case for change is overwhelming.

Lock-in operates across several domains at once (Helmrich et al., 2023):

Domain	How it locks the regime in
Technological	Infrastructure and standards built around the incumbent.
Economic	Sunk costs, scale advantages, and financing calibrated to the incumbent.
Institutional	Rules, and often the absence of rules, that favour the status quo.
Social	Communities, norms, and networks organised around current practice.
Individual	Habits, skills, and risk perceptions biased toward the familiar.
Epistemic	Where expertise sits, and what is believed about the alternative.

KEY POINT**Why this matters for measurement**

Because lock-in is multi-domain and self-reinforcing, a new technology's success depends far more on how it engages these barriers than on how good the artefact is. This is exactly why the Lab measures adoption in context rather than testing the device.

SECTION 4

How a niche breaks through

If lock-in explains why regimes persist, the next question is how a niche ever overcomes it. The answer is not that a niche wins on merit. It is that a niche builds up strength in a protected space until a window opens in the regime, and then breaks through.

The transitions literature calls the protected space a niche, and the work of building strength within it niche empowerment (Schot and Geels, 2008; Raven et al., 2016). Empowerment proceeds through three linked activities, each of which the Lab can observe and measure in the field.

Activity	What the niche is doing
Building networks	Assembling the suppliers, financiers, partners, and early users a new technology needs to function at all. Early on, this network is fragile and must be actively held together.
Cultivating expectations	Shaping what people believe the technology can become. Expectations attract resources and users; when they collapse, the niche loses its protection.
Learning by doing	Accumulating practical knowledge through use, about what breaks, what users actually want, and what the real cost of adoption is. This is where field evidence is most valuable.

Crucially, the niche cannot break through on its own timetable. It depends on a window of opportunity opening in the regime, usually because landscape pressure (a price shock, a policy shift, a crisis) has weakened the incumbent's grip. A niche that is ready when the window opens breaks through. A niche that is not ready misses it, and may wait years for the next.

- › Whether a niche is genuinely ready, its network robust, its expectations credible, its learning real, is an empirical question. It is one the Lab is built to answer before the window opens, not after it has closed.

SECTION 5

The shapes a transition can take

Transitions do not all unfold the same way. Geels and Schot (2007) identify four transition pathways, distinguished by the timing of landscape pressure and how ready the niche is when it arrives. Knowing which pathway you are in changes what a niche should do.

Pathway	How it unfolds
Substitution	A well-developed niche is ready when landscape pressure hits, and directly displaces the incumbent technology. The classic disruptive story, but rarer than it seems.
Transformation	Landscape pressure arrives before any niche is ready, so the regime itself gradually adjusts, absorbing new practices without being replaced.
Reconfiguration	The regime adopts niche innovations piece by piece, and is progressively rebuilt from within. Its architecture changes even though no single moment of replacement occurs.
De-alignment and re-alignment	A sudden shock breaks the regime apart before a successor exists; several niches then compete, and one eventually wins. The most turbulent path.

The pathways matter because they demand different strategies. A niche pursuing substitution must be technically ready and fast; a niche in a transformation pathway must work with incumbents, not against them. Misreading the pathway, preparing for a head-on substitution when the regime is actually reconfiguring, wastes effort and time.

The Lab's own BRW framework adds a fifth, finer-grained diagnosis, bounded leapfrogging, for the common case where a niche bypasses some barriers but must build others. It is explored in the companion BRW resource.

SECTION 6

Why transitions take the time they do

Transitions are slow, and then sometimes fast. Understanding the tempo protects against two common errors: expecting overnight change, and giving up just before acceleration.

Historically, large socio-technical transitions, from sail to steam, from horses to cars, from coal to gas, have unfolded over decades, not years (Turnheim and Geels, 2012; Sovacool, 2016). The reason is lock-in: every one of the six domains must shift, and they shift at different speeds. Infrastructure and institutions are slow; individual habits and expectations can move faster.

The slow build

For a long time, little visible change occurs. The niche accumulates networks, learning, and credibility below the surface, while the regime looks stable. Observers mistake this quiet phase for failure.

The fast break

Once a window opens and the niche is ready, adoption can accelerate sharply, an S-curve, not a straight line. Change that took twenty years to prepare can arrive in five.

KEY POINT

The measurement implication

Because the slow phase looks like failure and the fast phase arrives suddenly, point-in-time snapshots mislead. The Lab measures trajectory, baseline to endline, so a client can tell a slow build from a genuine dead end, which look identical in a single survey.

SECTION 7

Who wins, and who is left behind

A transition is never neutral. It redistributes cost, benefit, and risk, and the question of who gains and who loses is as important as whether the transition happens at all. This is the concern of the just-transitions literature (Newell and Mulvaney, 2013; Sovacool, 2021).

Two distributional questions recur in every transition the Lab studies:

- › Who can afford to adopt? A new technology often reaches the better-off first. If adoption stops there, the transition can widen an existing gap rather than closing it, even while its headline numbers look strong.
- › Who bears the cost of the old system's decline? Workers, communities, and businesses tied to the incumbent, petrol mechanics, fuel vendors, coal towns, carry real losses. A transition that ignores them provokes resistance and is often reversed.

This is why the Lab reads impact across reach, who is affected and who is excluded, not just aggregate adoption. A programme that reaches ten thousand people at the top of a market and a programme that reaches a thousand at the bottom are not the same, even when the headline count favours the first.

Aggregate success can hide distributional failure.
Whether a transition is just is a question the average
never answers, and one the Lab is built to ask.

READING A TRANSITION

SECTION 8

How transitions go wrong

Most technologies that could have transformed a sector did not. Studying the failures is as instructive as studying the wins, and a handful of patterns recur.

Failure pattern	What happens
The better mousetrap	A superior technology assumes it will win on merit, and never engages the regime's lock-in. It is out-competed by an inferior incumbent that owns the infrastructure and habits.
The stranded niche	A strong niche is ready, but no window opens. Landscape pressure never materialises, and the niche exhausts its resources waiting.
The premature lock-in	An early, partial solution scales fast and becomes the new incumbent, foreclosing a better transition that never gets its chance (Bauknecht et al., 2026).
The distributional backlash	A transition that concentrates benefits and imposes visible losses provokes organised resistance that stalls or reverses it.
The context transplant	A model that worked in one place is copied into another without re-reading the local regime, and fails on contact with different barriers.

Every one of these failures is a failure of reading, not of technology. Each could have been anticipated by studying how the technology met its specific context, before the capital was committed. That reading is what the Lab exists to provide.

SECTION 9

Transitions in the real world

The abstractions become clear in real cases. Each shows the same machinery, niche, regime, lock-in, at work. The first is the clearest bypass in modern development; the second shows why bypass is not always total.



Case one: M-Pesa. Mobile money bypassed a banking regime that excluded most people, rather than reforming it.

M-Pesa, launched by Safaricom in Kenya in 2007, is the most-studied technology transition in the development literature, and the cleanest real-world example of a bypass. It did not try to reform banking. It built a parallel system that made banking, in the form most people needed, unnecessary.

WORKED
EXAMPLE

Leapfrogging a locked-in banking regime

The regime. Conventional banking, locked in by physical branch networks, minimum balances, credit-history and formal-identity requirements, and paperwork. In 2006, before M-Pesa, only around a quarter of Kenyan adults had access to formal financial services; for most, moving money meant cash carried in person or sent with a bus driver.

The lock-in. The barriers were institutional (identity and paperwork rules), economic (branches are unprofitable to run in poor and rural areas), and infrastructural (no branch within reach). Crucially, the regime persisted through absence, the failure to serve most people, not through active defence.

The niche. M-Pesa let anyone with a basic phone store value and send it by SMS, cashing in and out through a dense network of small agents, the phone-credit sellers and kiosks that already existed. It bypassed the banking regime entirely rather than negotiating with it, and repurposed the mobile network and agent shops as its rails.

The evidence. Adoption reached roughly 96% of Kenyan adults. Research tracking households over years found that access to mobile money lifted an estimated 2% of Kenyan households out of poverty, with the effect strongest for female-headed households, who gained most from a private, portable store of value (Suri and Jack, 2016, Science).

The mechanism, read through BRW. Predominantly bypass, building a parallel payment system where the incumbent was absent, combined with repurpose, turning existing airtime agents into a cash-in-cash-out network. This hybrid is exactly what the BRW framework predicts for a porous regime held in place by absence.

The lesson. Where a regime persists through absence rather than active defence, a well-designed niche can leapfrog it almost completely. But this is the exception, not the template: it worked because the binding barriers were soft and institutional, not hard and physical.

SECTION 9, CONTINUED

When the leap is bounded

The second case shows the limit of bypass. Not every barrier can be leapfrogged; some must be physically built. Reading which is which is the whole strategic question, and it is the pattern the Lab studies most closely.



Case two: electric mobility. The petrol regime is held in place by fuel stations, combustion-trained mechanics, and rider habit, some of which a niche can bypass, and some of which it cannot.

Electric motorcycle taxis in Kenya show why the M-Pesa story does not simply repeat. The same country, the same appetite for leapfrogging, but a regime whose lock-in is partly physical, and physical barriers cannot be bypassed by software alone.

WORKED
EXAMPLE

A bounded, not total, leap

The regime. Petrol motorcycle taxis (boda bodas), the backbone of urban transport for millions. Locked in by roughly 4,934 retail petrol stations, a dense trade of combustion-trained roadside mechanics, informal financing tied to petrol vendors, and years of rider habit and trust.

The lock-in. Mixed. Some barriers are soft and discursive, the belief that electric bikes are unreliable, unfamiliarity, cost perceptions. Others are hard and material, charging infrastructure that does not exist yet, and a mechanic skill base built entirely around combustion engines.

The niche. Electric motorcycles paired with battery-swap stations and pay-as-you-go financing over mobile money, extending credit to riders with no formal banking history (itself riding on the M-Pesa rail from case one).

The evidence. Real breakthrough on the soft and financial barriers: financiers report that a majority of riders earn more on electric than petrol once running, and PAYG converts an impossible upfront cost into a daily payment. But adoption stays bounded by the hard barriers: riders lose hours to battery-swap scarcity, and electric maintenance skills remain thin.

The mechanism, read through BRW. A full portfolio: bypass for charging and financing, repurpose for retail and grid partnerships, weaken for the myths and cost perceptions. The soft barriers yield; the hard, high-coordination ones (charging density, mechanic training) resist and must be built.

The lesson. Not every barrier can be leapfrogged. The pattern is bounded leapfrogging: genuine, rapid progress in the domains that can be bypassed, coexisting with slow, physical construction in the domains that cannot. Knowing in advance which barrier is which is the entire strategic question, and it is empirical, not assumed.

SECTION 10

How to read a transition

The theory turns into a practical way of looking. Faced with any technology entering any context, ask these questions in order.

Ask	Because
What is the regime?	Every technology enters a world already run by an incumbent system. Name it before anything else.
What locks it in?	List the barriers across the six domains. The artefact's quality is rarely the binding one.
What is the niche doing to each barrier?	This is the strategic question: bypass, repurpose, or weaken (see the BRW resource).
Who adopts, and who is left out?	A transition that reaches only the top of a market has a different meaning from one that reaches the bottom.
What does the landscape do?	Is a window opening, or is the niche stranded waiting for one?

Reading a transition well is what makes steering it possible. Technology is not destiny: a transition can be guided toward people's values or away from them, but only if someone is reading it honestly, from the human side first.

WORKING WITH TRANSITIONS LAB

Reading, and then measuring

This primer gives you the lens. The Lab's engagements turn the lens on your specific case, with primary fieldwork. Where this guide explains how transitions work in general, an engagement reads how yours works in particular, and measures it.

IN THIS FREE RESOURCE	IN AN ENGAGEMENT, WE GO FURTHER
Name the regime and its lock-in	› A full barrier characterisation from field evidence, not desk assumption.
Classify the niche's strategy	› The BRW reading of what the technology is doing to each barrier, and where it will hold or stall.
Measure who is actually reached	› Reach, depth, and experience, read from the people themselves, on a baseline.
Return evidence you can act on	› A diagnosis and a measurement a decision can rest on, not a desk report.

The result is a diagnosis you can act on, grounded in how the transition actually works, and in what it is doing to the people living through it.

If a decision in your work turns on evidence of what a technology or programme actually does to real people, we are glad to talk it through, with no obligation. transitionslab.org

FURTHER READING

The foundations, for going deeper

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This primer draws on the sustainability-transitions literature and the Lab's own framework work. Use and cite with attribution to Transitions Lab. transitionslab.org