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Mapping Friction in the Residential Solar Loan Journey: An Exploratory Study of a Partner-Led NBFC Lending Model in India

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Abstract

Purpose. This paper examines how friction accumulates across the residential rooftop solar loan journey in India, using a non-banking financial company (NBFC) with a partner-led (B2B2C) origination model as its setting. It addresses the gap between policy optimism around the Pradhan Mantri Surya Ghar: Muft Bijli Yojana (PMSGY) and the thin management literature on how individual lenders experience and manage borrower drop-off.

Design/methodology. An interpretivist, exploratory single-case design, with the researcher embedded as participant-observer in the Relationship Management function of Solfin Sustainable Finance Private Limited for eight weeks. Data came from partner-portal operation, KYC and documentation support, and conversations with EPC (Engineering, Procurement and Construction) partners and borrowers across urban and rural micro-clusters. Field notes were manually coded against a six-stage journey frame and triangulated with policy, industry and peer-reviewed literature.

Findings. Friction is neither evenly distributed nor concentrated in the lender's credit engine. It peaks (1) between customer awareness and EPC/dealer pitch quality, where a financing-awareness deficit rather than genuine unaffordability suppresses funnel entry; (2) at digital KYC and documentation, where the verification architecture that speeds urban approvals becomes a barrier for rural and lower-digital-literacy borrowers; and (3) at the loan–installation interface, where EPC-side delay is experienced as lender delay. Five propositions received convergent support from field and secondary evidence.

Limitations. A single-case, eight-week qualitative study is analytically, not statistically, generalisable; transaction-level conversion data was unavailable, so severity and frequency judgements are directional.

Practical implications. Six interventions, including financing-led awareness messaging, a low-bandwidth vernacular KYC pathway and an EPC documentation scorecard, are sequenced by the priority of the friction each addresses.

Originality/value. The study offers a firm-level, process-oriented account of how macro-level barriers manifest inside a lender, in a partner-mediated rather than direct-to-consumer setting.

Keywords: customer journey mapping; residential rooftop solar financing; NBFC; B2B2C distribution; digital KYC; financial inclusion; qualitative case study; PM Surya Ghar Muft Bijli Yojana

Paper type: Research paper (exploratory qualitative case study)

1. Introduction

1.1 Industry Background and the Emerging Problem

India's rooftop solar segment has moved within roughly two years from policy aspiration to operationally contested growth market. The PMSGY, launched on 13 February 2024 with an outlay of about Rs 75,021 crore for one crore households, offers central financial assistance of up to Rs 78,000 per system and collateral-free loans at roughly 7 per cent (Ministry of New and Renewable Energy, 2024). Installations had crossed roughly 19 lakh systems by December 2025 (Ministry of New and Renewable Energy, 2025), yet most of the addressable market remains unconverted, and policy and survey evidence flag financing access rather than panel cost as the more persistent constraint (Mohammed, 2025; Council on Energy, Environment and Water [CEEW], as cited in Euronews, 2024).



This creates an empirical puzzle. Subsidy design and bank credit availability are no longer the binding constraint; what has not kept pace is an understanding of how lenders convert interested households into disbursed, commissioned loans, and where that process breaks down. Green-finance NBFCs such as Solfin, which originate almost entirely through third-party EPC and dealer partners, are bounded not only by their underwriting capacity but by an intermediary channel they do not fully control.

1.2 Conceptual Gap, Research Questions and Contribution

The literature on Indian rooftop solar adoption is either macro and policy-facing (national surveys, industry reports, policy reviews) or household-level and behavioural (Mathew and Pandian, 2024; Satapathy, Jain and Barthwal, 2021). Largely absent is a firm-level, process-oriented account of how these barriers play out inside a lender with a partner-mediated distribution model. Journey mapping and service blueprinting (Bitner, Ostrom and Morgan, 2008) have rarely been applied to emerging-market B2B2C green-asset lending, where friction can originate with the customer, the intermediary or the financier, and where separating these sources determines where managers should intervene.

RQ1. At which stages of the residential solar loan journey does friction concentrate, and what mechanisms (informational, procedural, technological, institutional) produce it in a partner-led NBFC model?

RQ2. How does this friction differ between urban and rural/semi-urban segments, and what does that imply for the design of awareness, verification and partner-enablement processes?

The objective is an empirically grounded, stage-wise friction map translated into propositions and practice recommendations, not the testing of a causal model (see Section 3). The paper contributes by (i) extending blueprinting and diffusion reasoning to partner-mediated green lending, (ii) showing how the national financing-awareness gap is experienced at the point of sale, and (iii) generating propositions for future quantitative work. Section 2 develops the conceptual model, Section 3 the method, Section 4 the findings, Section 5 the discussion, Section 6 the managerial implications and Section 7 the conclusion.

2. Literature Review and Theoretical Framework

2.1 Two Theoretical Lenses

Service blueprinting maps the front-stage and back-stage actions that make up a service experience in order to locate where quality breaks down (Bitner, Ostrom and Morgan, 2008); it suits lending because a loan is experienced as a sequence of interactions (application, verification, approval, disbursement), each a potential source of friction. Rogers's (2003) diffusion-of-innovation framework, widely used in the Indian solar literature (Satapathy, Jain and Barthwal, 2021), separates perceived innovation attributes from the channels through which information reaches the adopter, mirroring households who want cheaper electricity but do not know affordable financing exists. Together, blueprinting locates friction on the customer's timeline and diffusion theory explains why it recurs.

2.2 The Awareness–Affordability Distinction

Perceived and actual unaffordability are analytically distinct. CEEW's national survey reports that most households calling rooftop solar too expensive are unaware that financing exists (CEEW, as cited in Euronews, 2024). The distinction matters: affordability calls for price or subsidy intervention, awareness for communication intervention, and conflating them misallocates managerial attention. Mohammed's (2025) synthesis of the 2019–2025 literature corroborates that information asymmetry persists even as subsidy and approval portals have been digitalised.

2.3 Financing Access as a Structural Barrier

The awareness gap is not the whole story. Small ticket sizes, historically thin residential tariffs and the lack of repayment track records among first-time borrowers have discouraged mainstream banks from dedicated residential solar products, a gap specialist green NBFCs have entered. Even where awareness is resolved, small-ticket, thin-file lending remains a genuine structural constraint.

2.4 Household-Level Qualitative Evidence

Mathew and Pandian's (2024) interview study of Kerala households groups barriers into financial, informational and technical categories and finds them intertwined: an informational gap about financing compounds perceived technical and financial risk. This supports treating friction holistically across a journey rather than attributing it to one cause per stage.



2.5 Digital Verification and the Rural–Urban Divide

As Indian lenders shift to video KYC for fraud resilience and compliance, commentary notes that it continues to disadvantage elderly, rural and lower-digital-literacy customers, especially in lower-tier towns with unreliable bandwidth (Business Standard, 2025), consistent with financial-inclusion research identifying connectivity and identification constraints as first-order barriers in emerging markets. For an NBFC whose differentiation rests on digital underwriting speed, this implies a tension: the design choice that wins one segment may erode conversion in another.

2.6 DISCOM-Dependent Institutional Bottlenecks

Commissioning depends on state distribution company (DISCOM) net-metering approval, outside the control of both financier and installer. Where DISCOM-led support exists, timelines shorten; elsewhere they lengthen and become unpredictable (Mohammed, 2025). This friction persists however smoothly the loan itself is processed.

2.7 Conceptual Model

Synthesising the above, progress through the loan journey is jointly shaped by three actors: the customer's readiness (awareness, digital literacy, documents), the EPC/dealer partner's pitch quality and documentation discipline, and the lender's product and process design (underwriting speed, KYC architecture, disbursement structure), whose relative influence shifts across six stages (Table 1).

Table 1. Conceptual Model: Relative Influence of Each Actor by Journey Stage

Journey Stage	Customer Readiness	EPC/Dealer Partner	Lender Product/Process
1. Awareness	Low	High	Moderate
2. Consideration / Lead Generation	Moderate	High	Moderate
3. Application & Documentation	High	High	Moderate
4. Verification & Underwriting	High	Low	High
5. Approval & Disbursement	Low	High	Moderate
6. Post-Disbursement / Commissioning	Low	Moderate	Low (DISCOM-dependent)

2.8 Research Propositions

Consistent with theory-building case research (Eisenhardt, 1989), five propositions are framed as empirically testable statements assessed by the convergence of field and secondary evidence rather than as statistical hypotheses.

P1. In the PMSGY environment, a financing-awareness deficit, rather than a genuine affordability constraint, is the dominant inhibitor of funnel entry at the Awareness stage.

P2. In a B2B2C origination model, EPC/dealer pitch quality and documentation discipline are proximate, independent determinants of loan conversion, distinct from the lender's underwriting capability.

P3. Digital-first KYC generates systematically greater friction for rural and lower-digital-literacy customers than for urban customers at the Verification & Underwriting stage.

P4. Customers do not separate loan approval from physical installation; EPC-side delay is attributed to, and experienced as, financing delay even after credit decisioning concludes.

P5. DISCOM-dependent commissioning is a distinct, lender-uncontrollable friction stage whose unresolved status suppresses post-disbursement referral and advocacy.

3. Research Methodology

3.1 Stance and Design

The study is interpretivist: why a borrower disengages is constituted through meaning and interaction among customer, partner and lender. A large-sample survey with inferential statistics was considered and set aside, because an eight-week embedded placement could not support a representative sample, and retrofitting statistics onto an access-driven sample would produce false precision. The design is an exploratory, single-case, embedded qualitative study (Yin, 2018); the case is Solfin's residential rooftop solar loan journey and the embedded units are its six stages.



3.2 Context, Sampling and Data Collection

Solfin is a Gurugram-headquartered, Waaree Energies-backed NBFC that began lending in August 2024 and originates through more than 1,200 EPC and dealer partners across over ten states. The researcher was embedded in its Relationship Management function from 15 May to 15 July 2026. The unit of analysis is the journey stage, drawn from the blueprinting literature and Solfin's process map. Sampling was purposive and access-driven, governed by assigned tasks across four fortnightly phases and spanning urban and rural/semi-urban micro-clusters, trading statistical representativeness for operational depth.

Data came from four task-embedded streams: (i) operating the partner portal from profile creation to disbursement tracking; (ii) video-KYC and OTP verification support, including troubleshooting failed attempts; (iii) EPC/dealer visits and coaching sessions in urban and rural clusters; and (iv) structured and unstructured conversations with partners and, where appropriate, customers. Observations were logged in daily notes and fortnightly progress reports, providing a dated, auditable record.

3.3 Analysis, Trustworthiness and Ethics

Notes were manually coded against the six-stage frame following thematic analysis (Braun and Clarke, 2006): open coding, axial coding into recurring friction themes, and an interpretive pass cross-referencing themes with Table 1. Each theme was then checked against secondary literature unrelated to Solfin (Section 4.2) to test for idiosyncrasy and to assign indicative severity/frequency ratings.

Trustworthiness follows Lincoln and Guba (1985). Credibility rests on prolonged engagement and triangulation; transferability on thick description of context, though the single-case design limits it; dependability on the auditable report trail and explicit coding; and confirmability on deliberately seeking disconfirming evidence. Because the setting involves customer identity and financial data under RBI KYC/AML norms, no individually identifiable records are referenced; all observations are aggregated at pattern level.

4. Data Analysis and Findings

4.1 Field Engagement and Cross-Validation

The eight weeks ran in four fortnightly phases: platform immersion (portal, onboarding), compliance and verification exposure (KYC, documentation), external field diagnostics (urban and rural EPC/dealer visits) and partner sales-enablement with synthesis. Exposure to customers and partners deepened over time, so the richest observations came from the third and fourth fortnights. To address confirmability, each major theme was checked against independent sources (Table 2).

Table 2. Cross-Validation of Field Observations with Secondary Evidence

Field Observation	Independent Secondary Evidence	Consistency
Customers rarely ask about financing; most assume solar is unaffordable	CEEW survey: most households viewing solar as expensive are unaware financing exists (Euronews, 2024)	Consistent
Rural customers face added documentation and digital-KYC difficulty	Mathew and Pandian (2024); Mohammed (2025): barriers compound in under-served areas	Consistent
EPC/dealer pitch quality varies and shapes financing uptake	Literature on distribution-dependent solar financing	Consistent
DISCOM net-metering timelines affect perceived completion	Mohammed (2025): utility-side support materially affects commissioning speed	Consistent
Video KYC disproportionately burdens rural/low-digital-literacy customers	Business Standard (2025) on video-KYC and rural exclusion	Consistent

This convergence increases confidence that the themes extend beyond the partners and clusters visited, without claiming statistical generalisability.



4.2 Stage-Wise Journey Map

Table 3. Stage-wise Customer Journey Map: Residential Solar Loan

Stage	Key Touchpoints	Principal Friction Theme	Primary Evidence
1. Awareness	Word of mouth; EPC/dealer marketing; PMSGY publicity	Households assume solar is unaffordable without realising financing exists, so demand never reaches the funnel	CEEW survey (Euronews, 2024)
2. Consideration / Lead Gen.	EPC/dealer site visit and quotation; informal pitch	Financing pitched as a generic add-on; quality varies sharply by partner, especially new dealers	Field: coaching logs
3. Application & Documentation	Portal profile creation; ID, PAN, bank and income uploads	Manual or incomplete partner uploads cause bottlenecks; rural customers struggle to show formal income proof	Field; Mathew and Pandian (2024)
4. Verification & Underwriting	Video KYC; OTP consent; automated and manual credit checks	Video-KYC failures, OTP loops and connectivity issues cause retries and drop-outs, mostly rural	Field; Business Standard (2025)
5. Approval & Disbursement	Credit sign-off; e-signature; milestone-linked disbursement to EPC	Disbursement gated by installation milestones; an approved loan appears "stuck" if EPC delivery slips	Field: RM coordination records
6. Post-Disbursement / Commissioning	Net-metering application; DISCOM inspection; EMI onboarding	State-level DISCOM approval speed delays commissioning even after full disbursement	Mohammed (2025)

4.3 Friction Prioritisation and Urban–Rural Differential

Each theme was rated on severity (outright drop-off versus delay) and frequency (recurrence in logs and secondary corroboration). This is an interpretive judgement from coding, not a measured statistic (Table 4).

Table 4. Friction Point Prioritisation Matrix (Severity × Frequency)

Friction Point	Severity	Frequency	Priority
Financing-awareness gap (Stage 1)	High	High	P1 – Critical
Digital KYC / OTP failures (Stage 4)	High	Medium–High	P1 – Critical
EPC/dealer documentation quality (Stage 3)	Medium–High	High	P1 – Critical
Rural income-proof / financial-literacy gap (Stage 3)	Medium	Medium	P2 – High
Partner pitch inconsistency (Stage 2)	Medium	Medium	P2 – High
Loan–installation milestone mismatch (Stage 5)	Medium	Low–Medium	P3 – Moderate
DISCOM net-metering delay (Stage 6)	Medium	Low–Medium (state-dependent)	P3 – Moderate

Consistent with P3, friction was uneven by geography (Table 5).

Table 5. Urban vs. Rural Friction Differential

Dimension	Urban Customers	Rural / Semi-Urban Customers
Financing awareness	Relatively higher; more digital advertising and peer adopters	Lower; subsidy and financing awareness both weaker
Digital readiness for KYC	Generally smooth; reliable connectivity	More video-KYC retakes and OTP issues
Documentation readiness	Formal income proof more readily available	Greater reliance on partner help to assemble documents
Pitch style needed	Standard product-benefit pitch works	Localised, trust-based pitching performs better



4.4 Assessment of Propositions

Support is reported qualitatively, following qualitative theory-building convention, since no statistical test was performed or appropriate (Table 6).

Table 6. Qualitative Assessment of Research Propositions

Proposition	Field Evidence	Secondary Evidence	Support
P1: Awareness deficit dominates over affordability at funnel entry	Partners rarely led with financing; customers rarely asked	CEEW survey directly corroborates	Strongly supported
P2: Partner pitch/documentation quality independently determines conversion	Extensive coaching needed; document errors traced to partner entry, not underwriting	Consistent with distribution-dependency literature	Strongly supported
P3: Digital KYC creates differential rural/urban friction	OTP loops and KYC retakes concentrated in rural visits	Business Standard (2025) on video-KYC exclusion	Supported
P4: Customers do not separate approval from installation	RM coordination bridges loan-validation and EPC delivery dates	Indirect only; no direct empirical prior	Partially supported
P5: Unresolved DISCOM status suppresses referrals	EMI queries pre-dated commissioning confirmation	DISCOM literature; referral link inferential	Partially supported

P1 and P2 are strongest, as field coding and independent sources point to the same mechanism. P3 is well supported, though the secondary literature addresses retail KYC generally rather than solar lending. P4 and P5 are partial: the underlying behaviours (RM bridging, premature EMI queries) were directly observed, but the causal links to perceived delay and suppressed referral are inferred, since no post-commissioning customer interviews were in scope.

4.5 Major Findings

- **Finding 1.** The largest drop-off risk is pre-funnel: many households never engage with any financier because they are unaware financing exists, not because they rejected it.
- **Finding 2.** With fully partner-led origination, EPC/dealer training quality is a first-order determinant of conversion; Consideration-stage friction is mainly a partner-enablement problem, not a product-design problem.
- **Finding 3.** Digital-first underwriting is a double-edged choice: a speed advantage for well-connected customers, but disproportionate friction for rural and lower-digital-literacy ones.
- **Finding 4.** Customers experience loan and installation as one journey; delays in EPC delivery are perceived as financing delay even after credit processing concludes.
- **Finding 5.** The journey does not end at disbursement; DISCOM-dependent commissioning can leave an unresolved "not yet complete" perception that plausibly affects satisfaction and referrals.

5. Discussion

5.1 Interpreting the Findings Against the Literature

The findings reframe where friction sits in partner-led solar lending. Policy commentary often treats financing access as solved once a scheme exists and a lender will underwrite; here it is also a distribution and communication problem. This is consistent with the CEEW survey but shows the mechanism: EPC/dealer partners control the first substantive encounter with solar and do not consistently lead with financing, so the national awareness gap is reproduced at the point of sale rather than closed there.

The KYC findings (P3) extend the video-KYC and rural-exclusion literature into green lending, where stakes are arguably higher: a failed KYC attempt risks returning a customer to the "unaware, assumes it is unaffordable" pool, undoing the partner's awareness-stage conversion. This Stage 1–Stage 4 interaction, where a verification failure unwinds an earlier success, is not examined by either body of literature in isolation and emerges from treating the journey holistically.

The partial support for P4 and P5 is itself informative. Both concern how customers register delay originating outside the financier's control. The mechanism is established (RM staff bridging loan and delivery dates; EMI queries before



commissioning), but the customer-side conflation and its referral consequences were not directly observed, a limitation of an operationally focused field method that is flagged rather than overstated.

5.2 Theoretical Contribution

Blueprinting's front-stage/back-stage distinction, developed for single-firm encounters, needs modification in B2B2C settings: much of what customers experience as the lender's process is controlled by the EPC/dealer. The three-actor model in Table 1 is offered as a modest extension for intermediary-dependent financial services generally. It also bears on diffusion theory: Rogers (2003) treats communication channels as largely exogenous, whereas here the channel (the EPC/dealer) is a strategic variable the financier can train and incentivise.

6. Managerial and Practical Implications

The six recommendations follow Table 4 and address the three P1-Critical friction points first.

6.1 Lead with Financing in Awareness-Stage Messaging

Reposition financing availability as the primary message in EPC/dealer outreach, via co-branded collateral leading with low down-payment and EMI illustrations and a mandatory financing-pitch module in partner onboarding. This targets the most strongly supported finding (P1).

6.2 Build a Low-Bandwidth, Vernacular KYC Pathway

Offer an asynchronous document and short-video alternative in documented low-connectivity areas, piloted in a few rural micro-clusters with partner field staff assisting. OTP loops and video-KYC retakes were the most frequently coded Stage 4 drop-off source and hit the rural segment PMSGY most needs to reach.

6.3 Introduce an EPC/Dealer Documentation Scorecard

Generate a monthly per-partner scorecard of document completeness and first-pass approval from existing portal data, routing bottom-quartile partners into RM-led refresher sessions. Measurable accountability is the most direct lever on Stage 3 friction.

6.4 Synchronise Loan Milestones with a Customer-Facing Status Tracker

Extend the portal with an automatic status view (approved → disbursed to EPC → installation scheduled → commissioned), making combined progress visible and answering the conflation in Finding 4.

6.5 Activate a Structured Post-Disbursement Referral Programme

Invite referrals once DISCOM commissioning is confirmed, via the original EPC/dealer. This closes the “unresolved completion” perception (Finding 5) and turns satisfied customers into an awareness-stage channel, reinforcing 6.1.

6.6 Maintain an Internal DISCOM Net-Metering Turnaround Dashboard

Have RM field staff log approval against application dates, aggregated quarterly by DISCOM. Calibrating expectations by geography can reduce perceived financing delay where the true cause is external.

7. Conclusion, Limitations and Future Research

7.1 Conclusion

Drawing on an eight-week embedded engagement triangulated with independent literature, the study finds that friction concentrates less within the lender's deliberately speed-engineered credit process than at the boundaries between actors: customer awareness and the EPC pitch, partner documentation discipline and the underwriting engine, and loan approval and physical delivery. The five propositions received convergent but uneven support, with P1 and P2 strongest and P4 and P5 provisional. Addressing these boundary-level points, rather than further optimising an already-fast internal engine, is likely to yield the largest gains in conversion and customer experience.

7.2 Limitations

- The single-case qualitative design yields analytical, not statistical, generalisability.
- The eight-week window is a cross-section, not a longitudinal trace of one applicant cohort, limiting causal claims, especially for P4 and P5.
- Transaction-level, stage-wise conversion data was unavailable for confidentiality reasons, so Table 4 is a triangulated judgement rather than a measurement.
- As an embedded researcher, some bias toward the organisation's framing cannot be excluded, though the triangulation in Section 4.1 was designed to mitigate it.



- The secondary literature is richer on household perception and national policy than on partner-mediated distribution, constraining cross-validation of P3 to P5.

7.3 Directions for Future Research

- A multi-lender, stage-wise conversion study across partner-led NBFC and bank green-lending programmes could convert the qualitative ranking in Table 4 into comparable effect sizes.
- A longitudinal cohort design tracking applicants from first contact to post-commissioning would test P4 and P5 directly.
- A comparative study of whether the urban–rural KYC differential (P3) narrows after the low-bandwidth pathway in Section 6.2 would directly test that recommendation.

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