Original Research Article

To What Extent Do Rural Public Employment Schemes Contribute to Skill Formation and Sustained Employability Among Unskilled Rural Workers?

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ABSTRACT

Rural public employment schemes are among the most ambitious labour market interventions in the developing world, yet whether they generate durable improvements in worker employability, beyond income stabilisation, remains contested. This paper addresses that question through two complementary approaches. First, it reviews empirical evidence on rural employment schemes in India, Ethiopia, Argentina, and South Africa, including India's skill-oriented *Deen Dayal Upadhyaya Grameen Kaushalya Yojana* (DDU-GKY), to assess what the evidence shows about skill formation outcomes. Second, it builds a single-firm constrained optimisation model in which a representative firm, operating under a binding capacity constraint, allocates its workforce between unskilled production and training toward higher-skilled managerial roles. The model identifies three parametric regimes, full specialisation in training, a mixed allocation, and no training, governed by the marginal cost gap between skilled and unskilled labour relative to the demand premium for skilled output and the scale of the programme, and connects these conditions to structural features of programmes such as MGNREGA. Comparative statics show how training subsidies, market premia, and programme scale shift the boundaries between regimes. Read together, the empirical and theoretical results indicate that sustained employability gains require rural employment schemes to be paired with certified training, public-private coordination, and labour markets able to absorb newly skilled workers; absent these conditions, employment guarantees remain valuable safety nets but structurally limited instruments of human capital formation.

Keywords: Rural public employment schemes; Skill formation; Sustained employability; Human capital investment; MGNREGA; Labour market absorption; Training subsidies; Workforce allocation

INTRODUCTION

A persistent feature of rural labour markets across the developing world is what might be called a 'productivity trap': workers cycle through low-skill public employment, acquire no transferable capabilities, and return to the informal sector upon programme exit no more productive than when they entered. The trap is self-reinforcing — employers face weak incentives to invest in training when unskilled labour is abundant and cheap, while workers face weak incentives to seek skill formation when the immediate return to informal-sector work is comparable to the wage offered by public employment schemes. Governments across India, Ethiopia, South Africa, and Argentina have enacted large-scale rural

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public employment programmes in response to rural underemployment, yet whether these schemes can move workers out of this trap, rather than merely cushioning them within it, remains contested. Section 2 reviews that evidence in detail.

What remains absent from this literature is a framework connecting programme design features directly to private firms' incentives to invest in training and, through that channel, to sustained employability outcomes for rural workers. Existing work documents programme outcomes across countries but does not formalise why private underinvestment in training should be structurally expected in the parametric environment these schemes create.

This paper addresses that gap by linking programme design to firm training incentives. It argues that without deliberate government policy directed at skill development, rural employment schemes will improve income security but not sustained employability. The argument proceeds through two complementary analyses. First, we review the empirical record across four country cases to establish what determines whether skill formation occurs. Second, we develop a stylised single-firm model in which a firm operating under a binding capacity constraint allocates its workforce between producing a lower-quality good with cheap unskilled labour and training workers toward higher-skilled managerial roles. We derive the parametric conditions under which the firm chooses to train, to maintain a mixed allocation, or to abandon training entirely, and examine how the marginal cost gap between skilled and unskilled labour, demand conditions, and programme scale shift the boundaries between these regimes. These conditions reveal what India's Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and analogous schemes have structurally underspecified in their design, and why the transition from income stabilisation to productivity enhancement requires active policy intervention rather than market forces alone. While the model abstracts from many real-world complexities, this is by design: it is not intended to match the empirical record precisely, but to clarify the structural conditions under which underinvestment in training is not merely accidental but rationally predicted.

The rest of the paper is structured as follows. Section 2 reviews the relevant literature on rural public employment schemes and skill-oriented labour market interventions across comparable international settings. Section 3 outlines the theoretical model of a firm's production decisions under a binding capacity constraint, and derives the optimal conditions governing the firm's choice between unskilled production and investment in training, characterising three distinct parametric regimes. Section 4 explores the comparative statics of these regime boundaries and provides insights into the key factors, namely marginal cost gaps, demand premiums, and programme scale, that determine the firm's training decision. Section 5 concludes.

LITERATURE REVIEW

Workfare, Human Capital, And Employability

The literature on rural public employment schemes draws a consistent distinction between workfare-based social protection and human capital-oriented labour market interventions. Drèze and Sen (2013) argue that employment guarantees are normatively grounded in a rights-based welfare framework aimed at income stabilisation rather than productivity enhancement (1). From a capabilities perspective, such schemes enhance basic security but do not necessarily expand the range of productive opportunities available to workers.

Subbarao *et al*. (2013) similarly contend that public works programmes function primarily as counter-cyclical safety nets designed to mitigate consumption shocks during agricultural lean seasons (2). Their historical review of global public works programmes suggests that these interventions are rarely structured to generate certified skill acquisition.

Ravallion (2009) argues that the effectiveness of employment guarantee schemes depends critically on targeting and implementation quality. While such programmes can reduce poverty and provide coverage to the poor, their structural impact beyond income support remains limited in the absence of meaningful integration with broader labour market systems (3).

Human capital theory, by contrast, posits that sustained employability depends on transferable, productivity-enhancing skills that increase lifetime earnings potential. Gary Becker's (1964) foundational framework suggests that long-run employability outcomes depend on formal investments in training and skill development (4). When rural employment schemes lack structured training components, their capacity to influence long-term labour mobility and occupational mobility therefore remains limited.

Mgnrega And India: Employment Security Without Structural Skill Formation

India's Mahatma Gandhi National Rural Employment

Guarantee Act provides the most extensively studied case of a government-led rural employment guarantee programme. Enacted in 2005, the scheme guarantees up to 100 days of paid unskilled manual work per year to any rural household whose adult members are willing to do such work, covering over 50 million households across rural India at its peak.

MGNREGA has been well-documented as achieving its primary objective of income stabilisation. Imbert and Papp (2015) employ a difference-in-differences strategy using nationally representative National Sample Survey (NSS) data, exploiting the programme's phased district-level rollout between 2006 and 2008 to compare early-adopting districts against later-covered ones (5). They find that MGNREGA raised rural private sector wages by approximately 5%, with effects concentrated during the agricultural off-season, the period in which public works are most active. Klonner and Oldiges (2022) similarly combine administrative MGNREGA expenditure data with three rounds of National Sample Survey data to conduct regression discontinuity and difference-in-differences estimations, finding that the programme improved consumption smoothing and reduced income volatility among participating households, particularly at the extreme end of the poverty distribution (6). Sukhtankar (2017), reviewing the broader programme evaluation literature, further documents that MGNREGA strengthened the bargaining power of rural workers and reduced distress migration, functioning effectively as a wage floor for the rural poor (7).

However, many of these same authors also note a consistent failure in the dimension of skill formation. Imbert and Papp (2015) find no systematic evidence of enhanced occupational skill acquisition among programme participants, and Klonner and Oldiges (2022) conclude that productivity effects at the individual worker level were negligible (5,6). Azam (2012), using a difference-in-differences framework with NSS data and exploiting the phased implementation of MGNREGA across districts, finds that the nature of MGNREGA tasks, predominantly manual earthwork, infrastructure construction, and water conservation works, does not generate transferable or mobile occupational competencies (8). The scheme's design, as Sukhtankar (2017) observes, lacks any mechanisms for formal skill certification or structured pathways toward upward occupational mobility (7).

Multiple scholars, therefore, converge on the conclusion that MGNREGA, while successful in achieving income stability and providing a consumption floor, is not designed with formal training modules and thus has a limited contribution to structured skill development and sustained employability. In India, employment guarantee schemes have primarily served to stabilise incomes, set a minimum wage level, and provide employment during agricultural off-seasons, improving the long-term employability of workers only indirectly and weakly.

Skill-Specific Rural Programmes in India

Pilz (2016) argues that India's post-2014 skill development policy increasingly emphasises reforming vocational training systems and expanding market-relevant competencies to enhance employability, shifting the focus from short-term welfare-oriented employment support toward longer-term human capital investment (9).

In contrast to MGNREGA, the *Deen Dayal Upadhyaya Grameen Kaushalya Yojana* (DDU-GKY), a centrally sponsored scheme launched in 2014 under the Ministry of Rural Development targeting rural poor youth aged 15 to 35 years, explicitly integrates vocational training with job placement mechanisms and mandates employer partnerships as a condition of programme delivery.

Watane (2024) conducts a comprehensive analysis of secondary data from official DDU-GKY annual reports covering the period 2014–15 to 2021–22, examining trends in training enrolment and placement outcomes across the full eight-year span of the scheme (10). Drawing on descriptive statistics and trend analysis across a cohort of approximately 1.15 million trained candidates nationally, the study finds that the overall placement rate stood at around 62%, though placement rates varied considerably across years, peaking in 2016–17 and declining during the COVID-19 disruption of 2020–21. The study concludes that lasting results depend on training quality and the strength of employer linkages, with weaker industry coordination corresponding to lower placement retention.

Chakravorty and Bedi (2019), in a study based on survey data collected in mid-2016, comparing DDU-GKY-trained participants in rural Bihar against a control group of applicants who did not attend, find that the training programme reached its intended target group of rural poor youth and initially produced a 29 percentage point increase in the employment rate of trained graduates (11). However, employment effects dropped to near-zero within two to six months of programme completion, with a third of placed graduates exiting

due to caste-based discrimination and another third due to a mismatch between offered salaries and living costs. The study concludes that while training enhances short-run job market prospects, structural labour market factors, particularly caste barriers and wage adequacy, undermine sustained employment retention.

Dhiman (2025) argues that India's skill development initiatives more broadly suffer from fragmented implementation and limited industry-wide coordination (12). Without stronger private-sector integration and apprenticeship mechanisms, these programmes risk producing formal skill certification that does not translate into sustained employment outcomes, generating credentials without corresponding labour market absorption.

The Indian evidence therefore suggests that explicit skill integration improves employability prospects to some extent, but sustainability depends heavily on structural labour market absorption capacity and the quality of public-private sector cooperation.

COMPARATIVE INTERNATIONAL EVIDENCE

Ethiopia: Productive Safety Net Programme (Psnp)

Berhane *et al*. (2014) find that although Ethiopia's Productive Safety Net Programme improved food security and asset protection — its primary stated objectives — its public works component, like MGNREGA, did not significantly contribute to skill acquisition among participants (13). The programme's design prioritised asset-creation transfers and consumption smoothing over human capital formation, reflecting a similar structural orientation to India's employment guarantee. The programme similarly strengthened household resilience but produced limited evidence of structured labour market transformation or skill-based occupational mobility (13).

Argentina: Jefes Y Jefas De Hogar

Galasso and Ravallion (2004) evaluate Argentina's Jefes y Jefas workfare programme and find that, like MGNREGA, it reduced unemployment during the country's economic crisis of the early 2000s, but its impact on long-term employability was modest at best (14). They argue that workfare participants typically transitioned back into informal labour markets after graduating from the programme rather than into higher-skilled or better-compensated employment, reflecting the same failure to generate upward occupational mobility documented in the Indian and Ethiopian cases.

South Africa: Expanded Public Works Programme (Epwp)

Aliber's (2006) assessment of South Africa's Expanded Public Works Programme finds that although participants gained temporary employment and some work exposure, the programme, again like MGNREGA and PSNP, did not significantly increase long-term employment probabilities (15). Aliber emphasises that without formal training components embedded in programme design, employment guarantee schemes function more as poverty relief instruments than as tools for labour market transformation, reinforcing the pattern observed across all three comparative cases.

Synthesis

Across cases, the literature reveals a consistent pattern. Employment guarantee schemes enhance income security and labour bargaining power but do not systematically generate sustained, transferable skills. Skill-oriented programmes such as DDU-GKY improve employability prospects but face persistent retention and structural absorption challenges. Theoretically, rural employment guarantee schemes provide income security and basic stability, but long-term employability depends on building skills within a dynamic labour market. These schemes can therefore improve sustained employability only if they incorporate certified training, align with industrial needs, and operate within a growing economy capable of absorbing newly skilled workers.

METHODS AND MATERIALS

Model Overview

This section develops a single-firm constrained optimisation model to examine the conditions under which a firm will rationally choose to invest in skill formation rather than simply hiring unskilled labour. No strategic interaction between multiple agents, and no equilibrium concept, is involved; the framework is a single decision-maker's profit-maximisation problem under a binding capacity constraint. The model draws on the standard profit-maximisation model and extends it to a two-division capacity-allocation problem. The central research question concerns the parametric conditions that determine the optimal allocation of a fixed workforce between unskilled employment and training for higher-skilled supervisory or managerial roles, and the implications thereof.

This model, while a deliberate simplification, maps cleanly onto the structural conditions of rural public

employment schemes, most notably India's Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Ethiopia's Productive Safety Net Programme, and analogous interventions across Sub-Saharan Africa and South Asia.

The firm faces a fundamental resource allocation problem: given a fixed total output capacity, it must decide how much to devote to unskilled employment and how much to invest in training workers toward higher-skilled, managerial roles. This tension arises because the two divisions produce outputs of meaningfully different quality — unskilled workers produce a standardised, lower-quality good that commands a lower market price, while manager-trainees, workers producing output concurrently with training toward managerial roles, produce a higher-quality output that attracts a premium willingness to pay, and each division faces its own linear inverse demand curve derived from a representative consumer's valuation of that quality difference. Separate markets are justified on the grounds that unskilled and skilled outputs serve distinct buyers with categorically different needs — they are not substitutes on a quality continuum. A single quality-adjusted market would require buyers to observe and price quality differences continuously, which is implausible in the low-information rural environments this model is designed to capture; this mirrors the classic result that markets for goods of different, imperfectly verifiable quality tend to separate rather than clear as a single continuous market (16). We adopt this segmentation as a simplifying assumption suited to that setting rather than as an empirically estimated feature of any specific rural market; relaxing it, for example by allowing a continuous quality-price schedule, would smooth the sharp regime boundaries derived below into a continuous trade-off, without altering the qualitative conclusion that the marginal cost gap between skilled and unskilled production governs the firm's allocation decision. Formally, the model is parameterised as follows:

$L > 0$, the total quantity constraint that binds the firm's allocable output across both divisions, $Q_1 \geq 0$, output produced by unskilled workers, where $Q_1 = L - Q_2$ under the binding constraint, $Q_2 \geq 0$, output produced by manager-trainees, and the central policy variable of interest.

Two clarifications on interpretation follow directly from this setup. First, L, Q_1, and Q_2 should be read as worker-periods and output levels simultaneously: each division's technology is normalised so that one worker-period yields exactly one unit of that division's output, so that allocating workers and allocating output are the same decision. The quality and cost differences between the two divisions are carried entirely by prices (a versus d) and unit costs (c_1 versus c_2), not by differences in labour productivity. Under this normalisation, Q_2 is not the output of workers who have already completed training; it is the output produced concurrently with training, in an apprenticeship-style arrangement in which current productivity is reduced, and unit cost correspondingly raised, by the training overhead, exactly as the definition of c_2 specifies below. $Q_1 + Q_2 = L$ therefore describes a single-period allocation of a fixed pool of worker-time between unskilled production and training-cum-production, not a claim that training completes instantaneously before any output is produced.

Second, L is used in the comparative statics of Section 4 purely as a capacity, or programme-scale, shifter, holding the demand parameters (a, b, d, e) and the training cost gap ($c_2 - c_1$) fixed. This isolates the pure effect of scale on the firm's allocation decision. In practice, a larger programme could plausibly also shift these other parameters, for instance by saturating the market for skilled output more quickly (raising e) or by lowering the per-worker cost of training through economies of scale in provision (lowering c_2). The model does not capture these secondary channels, and the result that a larger L mechanically widens the interior regime should be read as a ceteris paribus finding, not a claim that scale alone improves training incentives under all circumstances. Combining scale effects with the demand- and cost-side effects that scale might also induce is a natural direction for future extension.

Demand And Revenue

The firm faces separate product markets for each division, each characterised by a standard linear inverse demand function:

$P_1 = a - bQ_1$ (Demand, Division 1)

$P_2 = d - eQ_2$ (Demand, Division 2)

Total revenue for each division is $TR_i = P_i \cdot Q_i$. Substituting the inverse demand functions:

$TR_1 = (a - bQ_1) \cdot Q_1 = aQ_1 - bQ_1^2$

$TR_2 = (d - eQ_2) \cdot Q_2 = dQ_2 - eQ_2^2$

a — Maximum willingness to pay for Division 1 output. This is the reservation price for goods or services produced by unskilled workers; the highest price the market will pay for one unit of Q_1;

b > 0 — Demand slope for Division 1. The rate at which the price falls as Q_1 increases, capturing how quickly the unskilled-labour output market saturates.

$c_1 > 0$ — Unit cost for Division 1. The marginal cost of employing one unskilled rural worker, including wages and any basic on-the-job overhead.

d — Maximum willingness to pay for Division 2 output. The reservation price for goods or services produced by manager-trainees reflects a premium market segment with higher valuations.

$e > 0$ — Demand slope for Division 2. The rate at which the price falls as Q_2 increases.

$c_2 > c_1$ — Unit cost for Division 2. The marginal cost of training and employing a manager-trainee encompasses training expenditure, higher wages, and reduced output during the transition period.

The assumption $c_2 > c_1$ reflects the higher marginal cost of skilled production, including training expenditures, higher wages, and transitional productivity losses. The assumption $d > a$ represents the typical case in which trained-worker output commands a price premium, providing the basic motivation for investment in training at all. Two further feasibility conditions are maintained throughout: $a > c_1$ and $d > c_2$. These require that the reservation price for each division's output exceed its own unit cost, so that each division is capable of earning positive profit in isolation; without them, one or both divisions would be unprofitable at any positive quantity regardless of demand conditions in the other division, and the regime classification derived below would no longer correspond to an economically meaningful choice between two viable production activities.

Profit Functions

Total cost is linear in quantity, reflecting constant marginal cost: $TC_i = c_iQ_i$. This yields per-division profit functions:

$\pi_1(Q_1) = (a - bQ_1)Q_1 - c_1Q_1$ (Profit, Division 1),
$\pi_2(Q_2) = (d - eQ_2)Q_2 - c_2Q_2$ (Profit, Division 2).

Aggregate Profit And Production Capacity Constraint

The firm maximises total profit subject to a binding total production capacity constraint:

$$\max_{Q_1, Q_2} \pi(Q_1, Q_2) = \pi_1(Q_1) + \pi_2(Q_2),$$

subject to: $Q_1 + Q_2 = L$, $Q_1 \geq 0$, $Q_2 \geq 0$.

The capacity constraint is modelled as binding rather than slack, and this is a maintained assumption rather than an automatic feature of the setup. Absent the constraint, Division 1 and Division 2 would each maximise profit separately at the unconstrained quantities $(a - c_1)/(2b)$ and $(d - c_2)/(2e)$ respectively. The constraint binds whenever the sum of these unconstrained division-level optima exceeds the available capacity, $(a - c_1)/(2b) + (d - c_2)/(2e) > L$, and we maintain this inequality as an assumption throughout. It is the empirically relevant case for the rural labour-market setting the model is designed to capture: employment schemes such as MGNREGA fix the scale of programme-linked activity available to a firm operating alongside them, through budgetary ceilings, guaranteed-workday quotas, or fixed project allocations, while the combined demand-driven optimum for unskilled and skilled output routinely exceeds that fixed allocation given the abundance of cheap unskilled labour such schemes make available. Under this assumption, the regime classification derived below characterises how the firm divides its already-exhausted capacity between the two divisions, rather than whether it exhausts that capacity at all.

Because the capacity constraint is an equality, we substitute $Q_2 = L - Q_1$ and reduce the problem to a single-variable unconstrained maximisation over Q_1. The full profit function then becomes:

$\pi(Q_1) = (a - bQ_1)Q_1 - c_1Q_1 + [d - e(L - Q_1)](L - Q_1) - c_2(L - Q_1)$.

RESULTS

First-Order Condition (Constrained)

The first-order condition identifies the candidate profit-maximising allocation, while concavity ensures that this candidate is the global maximum. Differentiating $\pi(Q_1)$ with respect to Q_1 and applying the chain rule to the Division 2 terms, noting that $Q_2 = L - Q_1$ and therefore $dQ_2/dQ_1 = -1$:

$$\frac{d\pi}{dQ_1} = (a - 2bQ_1 - c_1) - [d - 2e(L - Q_1) - c_2].$$

The first term in brackets is the marginal profit of Division 1 from increasing Q_1; the second term is the marginal profit of Division 2 from increasing Q_2, which enters with a negative sign because a higher Q_1 implies a lower Q_2 by virtue of the capacity constraint. Setting the derivative equal to zero:

$(a - c_1 - 2bQ_1) - (d - c_2 - 2e(L - Q_1)) = 0$

Expanding and collecting terms:

$a - c_1 - 2bQ_1 - d + c_2 + 2eL - 2eQ_1 = 0$

$(a - d) + (c_2 - c_1) + 2eL - 2(b + e)Q_1 = 0$

Optimal Quantities

Solving explicitly for Q_1:

$Q_1^* = [(a - d) + (c_2 - c_1) + 2eL] / [2(b + e)]$ − (Optimal Q_1)

The optimal quantity for Division 2 follows directly from the capacity constraint $Q_2^* = L - Q_1^*$:

$Q_2^* = L - [(a - d) + (c_2 - c_1) + 2eL] / [2(b + e)]$

Simplifying by writing L with a common denominator:

$Q_2^* = [2(b + e)L - (a - d) - (c_2 - c_1) - 2eL] / [2(b + e)]$

Expanding $2(b + e)L$ in the numerator and cancelling the 2eL terms:

$Q_2^* = [2bL + 2eL - (a - d) - (c_2 - c_1) - 2eL] / [2(b + e)]$

$Q_2^* = [2bL - (a - d) - (c_2 - c_1)] / [2(b + e)]$ — (Optimal Q_2)

The second-order condition requires that the second derivative of the profit function with respect to Q_1 be strictly negative at the critical point, confirming that the stationary point identified by the first-order condition is indeed a maximum rather than a minimum or saddle point. Differentiating the first-order condition once more with respect to Q_1:

$$\frac{d^2\pi}{dQ^2_2} = -2b - 2e = -2(b + e)$$

Since b, e > 0 by assumption, it follows that $-2(b + e) < 0$ everywhere. The profit function is therefore strictly concave in Q_1 globally, confirming that the critical point identified by the FOC is not merely a local maximum but a unique global maximum. The interior solution Q_1^* is valid when it satisfies the non-negativity constraints $Q_1^* \geq 0$ and $Q_2^* = L - Q_1^* \geq 0$. When these constraints are violated, the firm is pushed to a corner solution, giving rise to the regime classification derived later.

We now derive the parametric inequalities governing the three regimes. For notational compactness, define the composite parameter:

$A = a - c_1 - d + c_2 + 2eL$

so that $Q_1^* = A / [2(b+e)]$. All three conditions follow directly from the sign and magnitude of A relative to $L(b+e)$.

REGIME CLASSIFICATIONS

Regime I: Full Specialization In Skill Training (Candidate $Q_1^* \leq 0$; Constrained Optimum $Q_1 = 0$, $Q_2 = L$)

The unconstrained interior candidate is $Q_1^* = A / [2(b + e)]$. Regime I arises when this candidate fails the non-negativity constraint $Q_1 \geq 0$, or sits exactly on its boundary, so that $Q_1^* \leq 0$. Equivalently, since $Q_2^* = L - Q_1^*$, this is the case $Q_2^* \geq L$. Noting that the denominator $2(b + e) > 0$:

$A / [2(b + e)] \leq 0 \Rightarrow A \leq 0$

$a - c_1 - d + c_2 + 2eL \leq 0$

$c_2 - c_1 \leq d - a - 2eL$

When this condition holds, the interior candidate is not attainable, and the constrained optimum is the corner solution $Q_1 = 0$, $Q_2 = L$: the firm allocates its entire capacity to training. Note that $Q_2^* \geq L$ characterises the unconstrained candidate rather than the optimal allocation itself, which is bounded above by L.

The marginal cost gap must be sufficiently low relative to the demand premium for this corner solution to be optimal. The composite $A \leq 0$ arises when: (i) demand for skilled output is strong relative to unskilled (large $d - a$); (ii) the extra training cost is moderate (small $c_2 - c_1$); or (iii) the skilled-output market saturates slowly relative to capacity (small eL). In all these cases, the firm's unconstrained candidate for Division 1 is non-positive, so allocating the entire output capacity to training is optimal. Since $c_2 > c_1$ by assumption, the marginal cost gap $\Delta c = c_2 - c_1$ is always strictly positive, so the condition $\Delta c \leq d - a - 2eL$ can only be satisfied at all if its right-hand side is itself positive. Regime I therefore exists as a non-empty region of the parameter space only when $d - a > 2eL$: the demand premium for skilled output must exceed twice the product of its demand slope and the capacity constraint. Where $d - a \leq 2eL$, no positive cost gap can satisfy the condition, Regime I is vacuous, and the parameter space collapses to Regimes II and III alone.

Regime II: Interior Solution (Candidate $0 < Q_1^* < L$ Is Feasible; Optimum $Q_1 = Q_1^*$, $Q_2 = L - Q_1^*$)

This regime requires both quantities of goods to remain strictly positive, so that the interior candidate is itself feasible and therefore optimal. The interior solution $0 < Q_1^* < L$ holds when:

$d - a - 2eL < c_2 - c_1 < d - a + 2bL$

The lower bound ensures $Q_1^* > 0$, so the firm retains some unskilled production, while the upper bound ensures $Q_2^* = L - Q_1^* > 0$, so the firm also finds it worthwhile to allocate capacity to training. Both conditions must hold simultaneously for the interior regime to obtain. Both inequalities are strict: at either boundary the interior candidate coincides exactly with an adjacent corner, with $Q_1^* = 0$ at the lower bound and $Q_1^* = L$ at the upper, so the optimum there is a corner solution with one quantity equal to zero rather than a strictly interior allocation. These equality cases are therefore assigned to Regimes I and III respectively.

Regime III: Training Is Never Profitable (Candidate $Q_1^* \geq L$; Constrained Optimum $Q_1 = L$, $Q_2 = 0$)

Regime III arises when the interior candidate violates the capacity constraint $Q_1 \leq L$, or sits exactly on its boundary, so that $Q_1^* \geq L$. Equivalently, since $Q_2^* = L - Q_1^*$, this is the case $Q_2^* \leq 0$. From $Q_1^* = A / [2(b + e)]$, multiplying both sides by $2(b + e) > 0$:

$A \geq 2L(b + e)$

Substituting $A = a - c_1 - d + c_2 + 2eL$, expanding the right-hand side and cancelling the 2eL terms on both sides:

$c_2 - c_1 \geq d - a + 2bL$

When this condition holds, the constrained optimum is the corner solution $Q_1 = L$, $Q_2 = 0$. As in Regime I, $Q_2^* \leq 0$ characterises the unconstrained candidate rather than the optimal allocation, which is bounded below by zero.

The marginal cost gap must be sufficiently large for training to be entirely unprofitable. The Regime III threshold $d - a + 2bL$ is exactly the upper bound of the Regime II interior condition, with the boundary case itself assigned to Regime III. The three regimes are therefore mutually exclusive and exhaustive: Regime I obtains when $c_2 - c_1 \leq d - a - 2eL$, Regime II when $d - a - 2eL < c_2 - c_1 < d - a + 2bL$, and Regime III when $c_2 - c_1 \geq d - a + 2bL$, with no overlap or gap between boundaries.

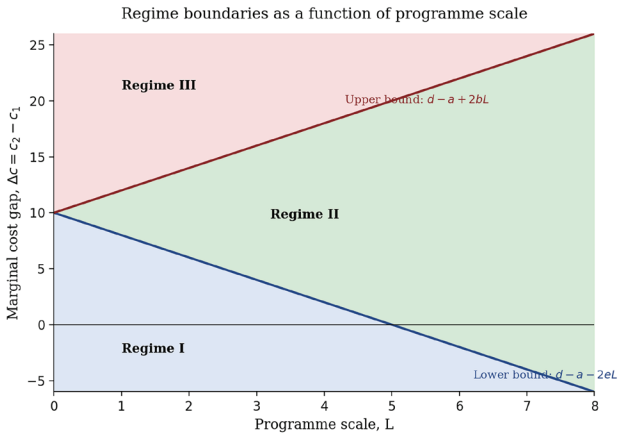

Figure 1. *Regime boundaries as a function of programme scale (L), shown for illustrative parameter values (d − a = 10, b = e = 1; axes not fitted to any specific country case). The lower boundary Λ = d − a − 2eL separates Regime I (full specialisation in training) from Regime II (interior, mixed allocation); the upper boundary U = d − a + 2bL separates Regime II from Regime III (no training is profitable). The shaded band widens as L increases, illustrating the comparative-static result that larger programme scale enlarges the parameter space supporting mixed private training investment.*

No training is profitable at any positive quantity. This is the market-failure zone: no private employer will invest in skill formation, even though the social return — which internalises skill spillovers, reduced long-run dependence on employment schemes and improved rural labour market outcomes — may substantially exceed the private return. This parametric region therefore provides the strongest theoretical justification for public intervention in the form of training subsidies or direct provision. Figure 1 illustrates how these three regimes and their boundaries shift as programme scale L increases.

DISCUSSION

Comparative statics examines how the optimal allocation between unskilled employment and skill training responds to changes in the underlying parameters. The central object of interest is the marginal cost gap $\Delta c = c_2 - c_1$, which appears on the left-hand side of all three regime boundaries.

Rather than asking what is the optimal Q_2^*, we ask: for what values of Δc does the firm choose to train at all, and how do demand and capacity conditions shift that threshold.

Recall from earlier that the interior regime requires:

$d - a - 2eL < c_2 - c_1 < d - a + 2bL$

This double inequality defines a band of cost gaps within which mixed workforce allocation is optimal. What the condition says is that the marginal cost gap must be neither so low that full specialisation in training becomes optimal (Regime I), nor so high that training ceases to be profitable altogether (Regime III). Only between these two thresholds does the firm find it optimal to hold both divisions open. We now derive how each boundary of this band shifts with every parameter in the model.

The Lower Bound: When Does Training Become Worthwhile?

The lower boundary of the interior regime is:

$\Delta c = d - a - 2eL$

This is the threshold at or below which the firm fully specialises in skill training (Regime I). The lower bound moves as follows:

Premium demand (d ↑)

A higher reservation price for Division 2 output raises $d - a$, pushing the lower bound upward. A stronger market for skilled output makes full specialisation in

training attractive even at a moderate cost premium, so a larger Δc is needed before an interior solution becomes optimal.

Unskilled output demand (a ↑)

A higher reservation price for Division 1 output lowers d − a, shifting the lower bound downward. This widens the interior regime band from below — the firm can accommodate a lower cost gap and still find it optimal to retain some unskilled employment rather than training the entire workforce.

Quantity constraint (L ↑)

Since the lower bound is d − a − 2eL, a larger total output capacity reduces it. As capacity expands, the demand-saturation effect of scaling up Division 2 grows, making full specialisation in training less attractive. This expands the interior regime downward, corresponding to the empirical observation that MGNREGA-scale interventions sustain large unskilled employment components even where premium market segments exist.

Demand slope for Division 2 (e ↑)

A steeper Division 2 demand curve reduces the lower bound via −2eL. If the market for trained-worker output saturates quickly, the firm has less incentive to concentrate all capacity in Division 2, and mixed allocation becomes optimal over a wider range of Δc.

The Upper Bound: When Does Training Cease to Be Profitable?

The upper boundary of the interior regime is:

$\Delta c = d - a + 2bL$

This is the threshold at or above which training is never profitable (Regime III). The upper bound rises under the following conditions:

Quantity constraint (L ↑)

The upper bound is directly proportional to L through the term 2bL. As total output capacity grows, the firm can absorb the per-unit training premium across a larger base and still find it profitable to allocate some output capacity to Division 2. This formalises the scale-sensitivity of training investment: the cost gap that prohibits private training at a small scale may fall comfortably within the feasible band at programme scale.

Demand slope for Division 1 (b ↑)

A steeper Division 1 demand curve means unskilled output markets saturate quickly. The upper bound rises with b because when Q_1 yields rapidly diminishing marginal revenue, the opportunity cost of diverting capacity to training is lower. In regions where the unskilled labour supply already depresses the marginal value of additional unskilled output, public training components therefore face a lower cost-gap hurdle.

Premium demand (d ↑) and unskilled reservation price (a ↓)

The upper bound rises with d − a. A wider premium gap means Regime III is pushed further out, i.e., training remains privately profitable even at larger cost gaps.

The Width of The Interior Regime Band

The interior regime is sustainable when the band is non-empty. Its width is:

$Width = (2bL + d - a) - (d - a - 2eL) = 2bL + 2eL = 2L(b + e)$

Three results follow immediately.

First, the interior band always has strictly positive width since L, b, e > 0, confirming that the interior regime is generically accessible for any parameterisation of the model. Second, width is strictly increasing in L. Larger programmes sustain mixed workforce allocation across a wider range of cost conditions. This is the central comparative static of the model: public employment schemes that operate at scale structurally enlarge the parameter space in which training and unskilled employment coexist, even without changing any market prices.

Third, the width is increasing in both b and e. Faster saturation of either market reduces the marginal gain from full specialisation in one division, pushing the optimum toward an interior mixed allocation.

Formal Comparative Statics

The verbal comparative statics above correspond to the following partial derivatives of the two regime boundaries. Writing the lower bound as $\Lambda = d - a - 2eL$ and the upper bound as $U = d - a + 2bL$: $\partial\Lambda/\partial d = 1$, $\partial\Lambda/\partial a = -1$, $\partial\Lambda/\partial L = -2e$, $\partial\Lambda/\partial e = -2L$, while $\partial U/\partial d = 1$, $\partial U/\partial a = -1$, $\partial U/\partial L = 2b$, $\partial U/\partial b = 2L$. These signs confirm each directional claim made above: the lower bound rises in d and falls in a, L, and e, while the upper bound rises in d, L, and b, and falls in a.

Positive mathematical width is a necessary but not sufficient condition for the interior regime to be empirically relevant: the band must also be positioned so that plausible real-world values of Δc actually fall within it, not merely that some non-empty interval

exists in principle. The country evidence reviewed in Section 2 suggests that Δc facing employers operating alongside MGNREGA-scale interventions is large relative to the demand premium for skilled rural output, d − a, placing these cases toward Regime III rather than inside the interior band regardless of programme scale. The interior regime is more plausibly occupied where training costs have already been substantially reduced, for instance through DDU-GKY's employer cost-sharing arrangements, or where local demand for higher-quality rural output is unusually strong. It is therefore best read not as a description of the typical operating environment of large public employment schemes, but as a policy target: the region that training subsidies and demand-side interventions are designed to move employers into.

CONCLUSION

This paper set out to examine the extent to which rural public employment schemes contribute to skill formation and sustained employability among unskilled rural workers. It did so through two complementary modes of inquiry: a structured review of the empirical literature on employment guarantee programmes across India, Ethiopia, Argentina, and South Africa, and a stylised model of a representative firm's workforce allocation decision under a binding capacity constraint.

The empirical record, reviewed in Section 2, reveals a consistent pattern across all four country cases. Employment guarantee schemes have been effective instruments of income stabilisation, consumption smoothing, and labour bargaining power reinforcement. These are meaningful achievements, particularly for households at the extreme end of the poverty distribution. However, across all four cases, the literature finds no systematic evidence that participation generates transferable occupational competencies, upward labour market mobility, or durable productivity improvements at the individual worker level. Programmes designed primarily around income security, without embedded training components or formal certification pathways, do not structurally improve employability. The model developed in Section 3 provides a structural explanation for precisely this pattern. Where unskilled wages are guaranteed by the state and the rural pool of skilled workers is negligible — the conditions MGNREGA itself presupposes — private employers face a marginal cost gap Δc that is large relative to the demand premium for skilled output. The model places these conditions squarely in Regime III, the market failure zone in which no private employer will invest in training regardless of programme scale. The empirical finding that MGNREGA participants consistently return to informal unskilled employment after exiting the scheme is therefore not a design failure in any narrow administrative sense; it is the predicted optimal allocation given the parametric environment the scheme creates.

The contrast with India's explicitly skill-oriented DDU-GKY programme sharpens this point. DDU-GKY's mandatory employer partnerships and certified training components represent, in the language of the model, a direct attempt to reduce Δc by sharing the cost of skill investment between the state and the private sector. Chakravorty and Bedi (2019) find that this initially produced a 29 percentage point increase in employment among graduates — consistent with the model's prediction that reducing Δc can shift employers from Regime III into the interior solution of Regime II. But retention collapsed within months, with graduates exiting due to caste discrimination, wage inadequacy, and weak industry absorption (11). The model clarifies why: even where training subsidies successfully reduce the cost gap, the interior regime requires that the demand premium for skilled output d be large enough relative to a to sustain the upper bound condition. Where structural labour market barriers compress that premium — because trained workers cannot be retained at wages that reflect their productivity — the parametric conditions for Regime II cannot be maintained, and the outcome reverts to the no-training optimum of Regime III. The evidence therefore suggests that explicit skill integration is necessary but not sufficient, and that programme design must be coupled with labour market conditions capable of sustaining the gains that training produces. DDU-GKY's fragility is thus not incidental but theoretically predicted. Future research might test the model's regime classifications empirically by estimating the structural parameters (training cost gaps, demand premia, and programme scale) across country cases, using household panel data and firm-level surveys to identify which parametric region each programme occupies and whether policy interventions produce the predicted regime shifts.

The comparative evidence from Ethiopia and Argentina reinforces this reading. Berhane *et al*. (2014) and Gilligan *et al.* (2009) find that Ethiopia's Productive Safety Net Programme improved household resilience but produced no skill-based occupational mobility (13, 17), while Galasso and Ravallion (2004) document the same pattern for Argentina's Jefes y Jefas programme (14). Both operate in environments where the structural cost

of training is high, the demand premium for skilled rural output is limited, and employer absorption capacity is weak — placing them, like MGNREGA, in the Regime III parameter space. South Africa's Expanded Public Works Programme represents a partial exception: by embedding training components directly in programme delivery, it acts in the model's terms as a supply-side reduction in Δc, and Aliber (2006) documents comparatively stronger employability outcomes as a result, though these remain contingent on the depth of training and the strength of employer linkages — exactly the conditions the model identifies as necessary to sustain the interior regime (15).

The comparative statics of Section 4 add a further dimension to this synthesis. The width of the interior regime band equals $2L(b + e)$, which is strictly increasing in programme scale L. Large-scale interventions therefore structurally enlarge the parameter space in which private training investment becomes rational, even without any change in market prices. This formalises a key policy implication that the literature gestures at but does not fully articulate: scale alone is not sufficient to generate skill formation. MGNREGA's own enormous scale has not moved its operating environment out of Regime III, because scale widens the interior band from both ends without changing the underlying cost gap Δc or the demand premium $d - a$ that determine where a specific programme actually sits relative to that band. Scale, combined with deliberate reduction of training costs through subsidies, public-private apprenticeship mechanisms, or direct provision, can shift the firm's optimal allocation in ways that neither scale nor subsidies alone can achieve, and in ways that small, fragmented interventions cannot replicate.

Taken together, the empirical and theoretical analyses converge on a common conclusion. Rural public employment schemes are valuable instruments of income security and social protection, and the literature is unambiguous on this point. But sustained employability gains require more than participation in unskilled public works. They require certified training aligned with market demand, public-private coordination structures that reduce the private marginal cost of skill investment, and broader economies capable of absorbing newly skilled workers at wages that sustain their employment. Without these structural conditions, employment guarantees remain welfare instruments of genuine importance but limited capacity to transform the productive potential of the rural workforce. The policy challenge is not to choose between income security and skill formation, but to design programmes that deliver both — and the framework developed here identifies precisely which parameters must shift, and in which direction, to make that dual objective privately as well as socially rational.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this article.

REFERENCES

1. Drèze J, Sen A. An Uncertain Glory: India and Its Contradictions. Princeton University Press. 2013. Available from: https://press.princeton.edu/books/hardcover/9780691160795/an-uncertain-glory (accessed on 2026-07-09). https://doi.org/10.2307/j.ctt32bcbm
2. Subbarao K, *et al*. Public Works as a Safety Net: Design, Evidence, and Implementation. World Bank Publications - Books. 2013. Available from: https://openknowledge.worldbank.org/entities/publication/767855ef-1cd1-570a-a2ef-09a9af9405a8 (accessed on 2026-07-09).
3. Ravallion M. How Relevant Is Targeting to the Success of an Antipoverty Program? *World Bank Res Obs*. 2009; 24 (2): 205-231. https://doi.org/10.1093/wbro/lkp009
4. Becker GS. Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. University of Chicago Press, Chicago. 1964. Available from: https://papers.ssrn.com/abstract=1496221 (accessed on 2026-07-09).
5. Imbert C, *et al*. Labor Market Effects of Social Programs: Evidence from India's Employment Guarantee. *Am Econ J Appl Econ*. 2015; 7 (2): 233-263. https://doi.org/10.1257/app.20130401
6. Klonner S, *et al*. The welfare effects of India's rural employment guarantee. *J Dev Econ*. 2022; 157: 102848. https://doi.org/10.1016/j.jdeveco.2022.102848
7. Sukhtankar S. India's National Rural Employment Guarantee Scheme: What Do We Really Know about the World's Largest Workfare Program? *India Policy Forum*. 2017; 13 (1): 231-285.
8. Azam M. The Impact of Indian Job Guarantee Scheme on Labor Market Outcomes: Evidence from a Natural Experiment. IZA Discussion Paper No. 6548. 2012. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1941959 (accessed on 2026-07-09). https://doi.org/10.2139/ssrn.2062747
9. Pilz M. India's skills challenge: reforming vocational education and training to harness the demographic dividend. *J Vocat Educ Train*. 2016; 68 (2): 280-281. https://doi.org/10.1080/13636820.2016.1180814

10. Watane DUH. Trends and Challenges in Rural Employment through Deen Dayal Upadhyaya Grameen Kaushalya Yojana: A Study from 2014 to 2022. *Educ Adm Theory Pract*. 2024; 30 (9): 1256-1262. https://doi.org/10.53555/kuey.v30i9.11072
11. Chakravorty B, *et al*. Skills Training and Employment Outcomes in Rural Bihar. *Indian J Labour Econ*. 2019; 62 (2): 173-199. https://doi.org/10.1007/s41027-019-00167-8
12. Dhiman D, *et al*. Shaping skills: A qualitative dive into India's evolving skill development policies. *Dev Policy Rev*. 2025; 43 (3): e70006. https://doi.org/10.1111/dpr.70006
13. Berhane G, *et al*. Can Social Protection Work in Africa? The Impact of Ethiopia's Productive Safety Net Programme. *Econ Dev Cult Change*. 2014; 63 (1): 1-26. https://doi.org/10.1086/677753
14. Galasso E, Ravallion M. Social Protection in a Crisis: Argentina's Plan Jefes y Jefas. *World Bank Econ Rev*. 2004; 18 (3): 367-399. https://doi.org/10.1093/wber/lhh044
15. Aliber M, *et al*. Overcoming underdevelopment in South Africa's second economy. *Dev South Afr*. 2006; 23 (1): 45-61. https://doi.org/10.1080/03768350600556356
16. Akerlof GA. The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *Q J Econ*. 1970; 84 (3): 488-500. https://doi.org/10.2307/1879431
17. Gilligan DO, *et al*. The Impact of Ethiopia's Productive Safety Net Programme and its Linkages. *J Dev Stud*. 2009; 45 (10): 1684-1706. https://doi.org/10.1080/00220380902935907