International Initiative for Impact Evaluation

Rapid evidence assessment brief

Transportation

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Do performance-based contract models perform?

Transportation networks connect economies and facilitate cooperation, which makes them crucial to both economic and social development. Poorly maintained roads constrain trade and mobility, raise vehicle operating costs, increase accident rates, and aggravate isolation and poverty.[1] In recognition of this, in 2019 about 86 billion US dollars were invested in strengthening transport infrastructure, and performance-based contracting (PBC) mechanisms emerged as a popular tool for financing road construction and maintenance.[2] In PBC arrangements, payment for road works is contingent on road quality upon completion of construction and maintenance works.

A number of studies report benefits associated with PBC use, including cost savings, reduction of labor requirements, improved road conditions, greater user satisfaction, and mechanisms for financing longer-term maintenance. However, the evidence base supporting the use of PBC is largely based on descriptive, observational, and/or case study methods for PBC implemented in high-income countries.[3] Many studies are not rigorously compared to a counterfactual, making it difficult to validate effectiveness estimates. Furthermore, studies on PBC in high-income countries may not be generalizable to low- and lower-middle-income countries' (L&LMICs) contexts.

Highlights

- Compared to traditional road maintenance contracting mechanisms, PBC may reduce costs by 9 to 19 per cent.
- Evidence of the impact of PBC on road quality varies, but two studies report moderate improvement.
- Clear performance indicators and well-constructed preliminary design in bidding documents helps contractors to submit strong proposals.
- PBC can reduce bureaucracy and improve efficiency at road agencies by making them more cost-effective.
- Rigorous evidence on the effectiveness of PBC in L&LMICs is limited; further research should be conducted to inform future investment in transportation infrastructure.

Created by the US Congress in 2004 with strong bipartisan support, the Millennium Challenge Corporation (MCC) is an innovative and independent US government foreign assistance agency that helps to lead the fight against global poverty. MCC partners with developing countries that are committed to good governance, economic freedoms, and investment in their own citizens, and delivers large-scale grant programs to reduce poverty through economic growth.

MCC is investing in road maintenance contracts for the Benin-Niger regional compact. They commissioned the International Initiative for Impact Evaluation (3ie) to answer the question: What impacts does PBC in road construction have on cost savings, road quality, collaboration, and direct user benefits in L&LMIC contexts? To this end, 3ie conducted a rapid evidence assessment to synthesize the available rigorous impact evaluations of PBC in L&LMICs.

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Main findings

The study team identified 1,589 articles; five studies met all eligibility criteria. One study measured the impact of road works under output- and performance-based road contracts (OPRCs) on agriculture production in Zambia. Two studies analyzed the Contrato de Recuperación y Mantenimiento (CREMA) project in Argentina and Brazil. The remaining two studies focused on PBC in Indonesia and Sri Lanka.

PBC performed better at improving road quality measures and frequency of maintenance works than traditional contracting. Two studies compared PBC quality improvement to that of traditional contracts. In a study carried out in Zambia, roads that were part of OPRCs increased their likelihood of receiving maintenance work by 18 percentage points. Another study in Sri Lanka found that PBC roads received better quality ratings. In Brazil, CREMA roads performed better on the International Roughness Index and Brazil's Índice de Gravidade Global Expedito.

PBC had lower costs than traditional contracting. The three studies that performed cost analyses found that costs for PBC roads were reduced by 9 to 19 per cent.

PBC increased agricultural production. Only one study, in Zambia, looked at the downstream effects of using PBC on productivity. The study found that, relative to comparison areas, those with PBC had a 50 per cent increase in maize production. The authors found that gains in productivity, deemed to result from being in a PBC area, occurred in localities where road work was actually performed. However, the road improvements resulting from PBC did not have an impact on revenue from market sales.

The included studies all had a high risk of bias. Most studies were not impact evaluations; they used non-experimental designs that did not construct a strong counterfactual that could address issues of confounding and selection bias. Even the one impact evaluation included had difficulties with comparability between the treatment and control groups.

Table 1: Effects from studies included in the rapid evidence assessment

Study	Country	Intervention type	Effect of intervention on roads
Iimi and Gericke (2017)[4]	Zambia	OPRCs	■ Increase in road works performed
Lancelot (2010)[5]	Brazil	PBC of road maintenance and rehabilitation (CREMA)	■ Improved road quality ■ Improved cost-effectiveness
Silva and Liautaud (2011)[6]	Argentina	PBC of road maintenance and rehabilitation (CREMA)	■ Improved cost-effectiveness
Susanti et al. (2019)[7]		PBC for road improvement and maintenance	■ Improved cost-effectiveness
Thennakoonwela (2011)[8]	Sri Lanka	PBC	■ Improved road quality

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Considerations for implementation, sustainability, and evaluation of PBC for road maintenance

Clear performance indicators and well-constructed preliminary design in bidding documents helps contractors to submit strong proposals. Well-defined performance indicators reduce ambiguity and avoid exposing contractors to additional risk that may increase the tender price. Having a recent preliminary design that is based on up-to-date inspections and provides sufficient detail ensures that bidding contractors can submit accurate and appropriately priced estimates of the work to be performed.

Bundling rehabilitation and maintenance into the same contract improves program success. Combining these two services incentivizes the contractor to perform well with regard to rehabilitation in order to prevent issues that may increase maintenance costs later. If the two services are combined, outcomes should be measured at least four to five years after the work begins to be able to isolate the effects from maintenance.

Penalty values should be appropriately balanced to ensure compliance. Including penalties in the contract ensures that contractors are incentivized to be compliant with contract performance standards. However, the penalty value should not be so high that contractors are no longer incentivized to perform maintenance road works, or that they increase their tender price.

Using PBC can secure availability of funding for road maintenance, even during budget shortages. Road networks that do not have built-in revenue sources, such as tolls, can benefit from secured maintenance funding from PBC. However, in most countries, there is a dependence on external funding sources to support these mechanisms and a need to develop internal funding sources.

Insufficient PBC training for road authority staff and contractors affects the intervention's effectiveness. Government agency staff must be trained to ensure that contracts are appropriately managed and there is buy-in at all levels of the agency. Because contractors hold additional risk under PBC, it is important that they are adequately trained to ensure the program's success.

Implications

For programming and policy: PBC can reduce bureaucracy and improve efficiency at road agencies by making them more cost-effective. Bidding documents should be sufficiently comprehensive so that contractors can submit accurate and competitively priced bids. To ensure this contracting mechanism is effective, road agency staff and contractors should be properly trained in the use of PBC. There also needs to be a diversification of funding sources to support the use of PBC, which currently is supported primarily by external funders.

For impact evaluations: In general, there is a need for additional research on the effectiveness of PBC. Because these contracting mechanisms are often implemented on large sections of national roads, it may be challenging to randomize and identify adequate control groups. If PBC implementation areas are selected due to their potential for increased economic gains or productivity, there could be endogeneity issues. Mitigation strategies to address potential endogeneity should be incorporated into the selected evaluation design. Model identification strategies should be carefully considered prior to commencing any research project.

In addition to available administrative data on contract structure, research projects should collect information at various time intervals to be able to isolate the effects of rehabilitation from maintenance and management effects. Furthermore, spatial data capturing information related to terrain and baseline road characteristics should be collected to be used as covariates.

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Endnotes

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What is a rapid evidence assessment?

A rapid evidence assessment is a targeted systematic review. Similar to a systematic review, it uses a systematic approach to search and screen studies for inclusion. To make it rapid, the search strategy could be limited to certain databases and the scope may be narrowed to focus only on a few intervention types.

About the rapid evidence assessment

This brief is based on the MCC-funded *Rapid evidence assessment on use of performance-based contracts for road maintenance projects,* by Sridevi Prasad, Jane Hammaker, Katherine Quant, and Douglas Glandon. The authors found and appraised the quality of five impact evaluations and economic evaluations of the use of PBC in road maintenance interventions in L&MICs.

About this brief

This brief was authored by Jane Hammaker, Katherine Quant, and Sridevi Prasad. They are solely responsible for all content, errors, and omissions. This study is made possible by the generous support of the US Government through MCC. The contents are the responsibility of the 3ie and do not necessarily reflect the views of MCC or the US Government. This brief was designed and produced by Akarsh Gupta and Tanvi Lal.

The International Initiative for Impact Evaluation (3ie) is an international grant-making NGO promoting evidence-informed development policies and programmes. We are the global leader in funding, producing and synthesising high-quality evidence of what works, for whom, how, why and at what cost. We believe that using better and policy-relevant evidence helps to make development more effective and improve people's lives.

For more information on 3ie's Rapid evidence assessment brief, contact **info@3ieimpact.org** or visit our website.

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