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Tracing the causal loops through local perceptions of rural road impacts in Ethiopia

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Abstract

To better grasp the interconnected range of socioeconomic impacts from the implementation of rural roads in northern Ethiopia, we have experimented with Causal Loop Diagrams (CLDs), a tool commonly used in systems dynamics, but generally under-used in development research. The expansion of the rural road network in Africa is praised for reducing spatial isolation, lowering transport cost, increasing access to markets and bringing services closer to home. However, different segments of society will benefit differently from the establishment of a rural road. This difference may lead to dynamics that either exacerbate or reduce existing inequities, which forms the central question for this paper.

As part of a broader study on the multiple (in)direct effects of rural roads on productive employment, we undertook oral testimonies in four municipalities to explore how people perceive road impacts on livelihoods, mobility and work. CLDs were then used to assemble those seemingly loose observations into a systematized view of the whole. The exercise reveals conflicting feedback processes that may dominate system at different times and drive the inequities between surplus food producers and labourer households up or down. The method used can be particularly useful for studying similar infrastructures that seemingly bring benefits to all, but may cause subtle, concealed or delayed effects, and ultimately surprising system behaviour.

Perceptions of rural roads

Subjective perceptions of rural road impacts from a diversity of respondents were collected through oral testimonies. CLDs were then used to assemble these seemingly loose observations into a systematized view of the whole. Although the CLDs were therefore created by the authors, the individual nodes are based on local perceptions. Figure 1 shows the total picture. We now highlight a part of the total picture, supported with sample quotes from the oral testimonies.

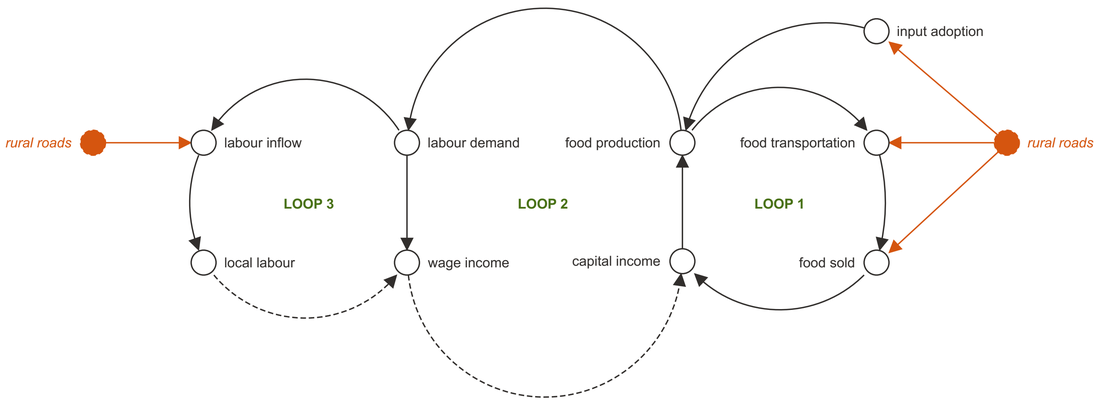


Figure 2. Partial CLD

"Formerly, people were mostly consuming what they produced and were not conscious about markets"; "These days, if I have customers in town, I rent a horse cart, I come here and dig out the product and transport it to town. The income itself has increased". "The road benefits more the poor. If the road and transportation are available, the poor will have a lot of opportunities to engage in different day-labouring and business activities, to move here and there"; "There is more mobility and there are more people engaged in day-labouring". "When there are a lot of labourers, the employers decrease the wage rate. Sometimes it's 100 birr and sometimes it's 80 birr per day. In the worst case it can go down to 30 birr per day".

- Loop 1: Figure 2 indicates a reinforcing feedback loop of increased production and selling. The road speeds up the process. Production is stimulated through better access to inputs. The increased output is transported and sold on markets. Producers and consumers both have better access to these markets. This increases the income of farmers who can further invest in their production.
- Loop 2: Figure 2 also indicated a balancing feedback loop that would work to reduce the gap between households that earn mostly from surplus production and households that rely mostly on waged-employment. The increased production raises labour demand as well as wages, which lowers profits and income of the employers.
- Loop 3: Finally, the balancing effect of Loop 2 might be counteracted by another feedback loop. Increased labour demand might attract an inflow of labour from the outside, which would increase the size of the labour force that is locally available for work. This would in turn would lower—not raise—labour wages.

Shifting dominance

The total CLD of the perceived system from Figure 1 depicts multiple feedback loops. Some of these compete with each other, i.e., feedback loops can drive the system in different directions. An example of this has been highlighted in Figure 2: two conflicting feedback loops act on labour wages, either to increase it or decrease it. Similar competing loops are affecting food prices. Together with wage fluctuations, food price fluctuations could threaten the terms of trade of impoverished market-dependent consumers. In system dynamics, this is referred to as shifting dominance. Meadows and Wright (2008:44) explain that "when one loop dominates another, it has a stronger impact on behaviour. Because systems often have several competing feedback loops operating simultaneously, those loops that dominate the system will determine the behaviour".

The aim of this exercise was not to predict shifting dominance in the system, but to question the widespread assumption in neoclassical models that rural roads will merely stabilise prices, increase wages and reduce inequities. Further research could inquire into the relative importance of the different feedback loops and their implications for income or wealth gaps, for food production and distribution, for employment, and so on.

Reference: Meadows, D. H., & Wright, D. (2008). Thinking in systems: A primer. White River Junction: Chelsea Green.

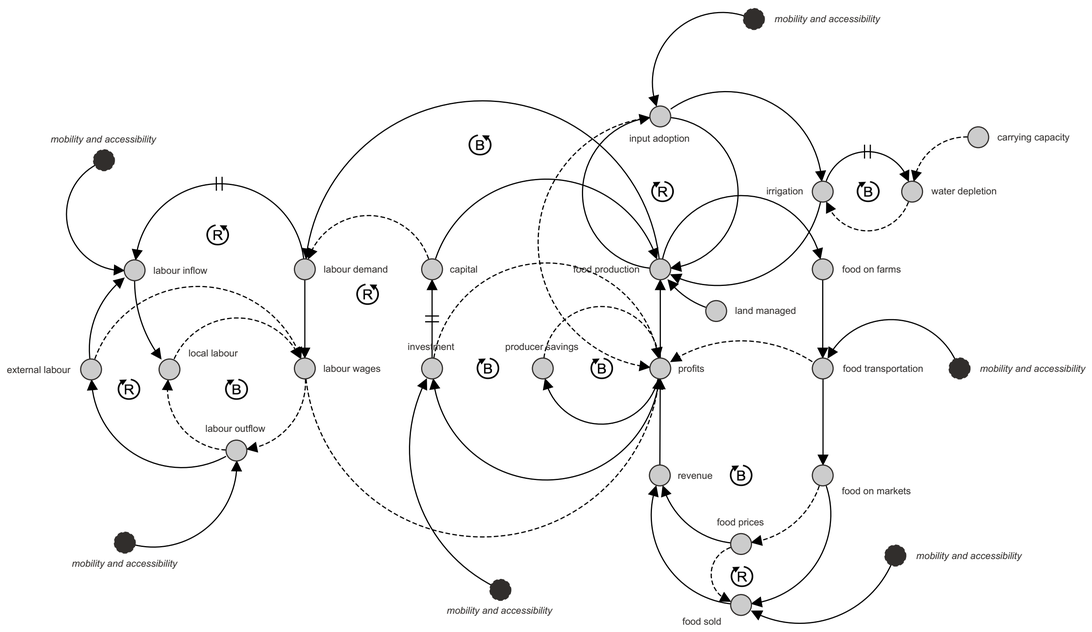
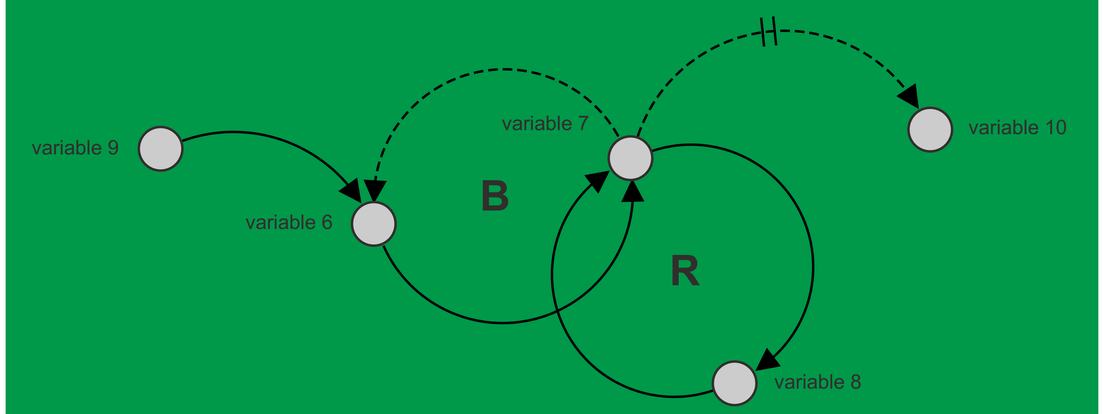


Figure 1. Total CLD of the perceived system

Methodology: Causal Loop Diagrams

Our data analysis and synthesis technique is the Causal Loop Diagram (CLD). This is a system modelling technique utilised to qualitatively reflect on variables and interrelationships. CLDs consist of nodes and links. In a 'positive' causal link, the influenced node changes in the same direction as the influencing node. For example, if variable_1 in the figure below decreases, variable_2 also decreases. A solid line indicates a positive causal link. A 'negative' causal link (dotted line) means the two nodes change in opposite directions. Influences can also be delayed (//) relative to other influences in the system. CLDs can include phenomena by which a process is influenced by its own outcome, i.e., feedback. We refer to balancing feedback (B) when the influence slows down the process and to reinforcing feedback (R) when the influence speeds up the process. These mechanisms largely define the dynamics of systems over time. As suggested in the introduction, there is a need for tools that reveal the structures that potential drive a system away from equilibrium, which is one of the purposes of a CLD.



Ethiopia: Feeder road development for inclusive productive employment

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