# Would the Physical Internet Deliver in Poor, Deprived Areas?

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## Introduction

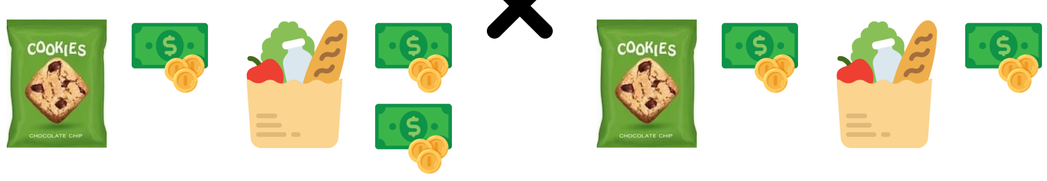
People living in favelas are buying their food locally, from small family stores – called by researchers "nano-stores" (Fransoo et al, 2017). Most of the food sold by these nano-stores is prepackaged food, of low nutritional value, and very unhealthy if consumed exclusively.

There are a number of constraints and difficulties for the favela's population to buy fresh produce (dairy, fresh meat, eggs, green veg, and fruit), like:

- Need to leave favela and visit open markets;
- Limited offer of products ;
- Transportation by local small transporters with improvised vehicles from the DCs to the nano-stores;
- Lack of adequate (or any) public transport infrastructure to go outside the favelas to buy.

Paradoxal situation – favela inhabitants pay more for food than the rich neighbours:

Favelas  Outside neighborhoods 




Most of the current research is empirical and not normative → causes and punctual solutions.

We need a system design based on advanced concepts in logistics → exploring the problem, the context, the stakeholders, the requirements, functional, physical and operational architectures.

- Fransoo, J., Blanco, E.E., & Mejia Argueta, C. (2017). Reaching 50 million nanostores: retail distribution in emerging megacities, CSIPP, Cambridge.

## PI micro-hubs and their use in favelas

The PI concept is not yet fully investigated from a problem-solving-via-a-system-design perspective, and there are still serious gaps in the overall vision for this concept – even more those related to food and especially fresh food shipments.

↓

"Last-mile" segment

- Expected that all PICs reach the geographical point of use of the supplier and the consumer.
- This is impractical for favela nano-store shipments:
  - Smaller size;
  - Transportation;
  - Security;
  - Economics.

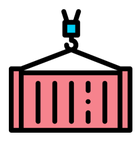
To be investigated: the design of a PI-oriented system that always uses PI micro-hubs as intermediate fresh food staging between the DCs and the nano-stores.

- Basis for a micro-hub concept:
  - Expand the PI architecture with the City Logistics Smart Rack (CLSR)
  - Nowadays: shipments are brought by suppliers to a Smart Rack, encapsulated and authorized transporters take to the consumers.

- Innovation proposed by Montreuil (et al, 2016), and expanded by Faugere (and Montreuil, 2017):
  - Combine the rack with PICs;
  - Issues with the weight carried (the containers have to be secure from break-in);
  - Special secure location for the containers (inside or outside the favela);
  - Encapsulation and decapsulation by an authorized intra favela transporter.

- Micro-hub concept (based on CSLR)


- Favela oriented



- Empty container
- Not carried to the final point of use

- Final consumer by from nano-stores

- Faugere, L., & Montreuil, B. (2017). Hyperconnected Pickup & Delivery Locker Networks, Proceedings of the 4th PI Conference, Graz, Austria.
- Montreuil, B., Ballot, E., & Tremblay, W. (2016). Modular Design of Physical Internet Transport, Handling and Packaging Containers, Progress in Material Handling Research (Vol. 13): MHI, Charlotte, USA.
- de Vries, M. (2018). Last mile delivery within the PI, Master thesis, Groningen University.

## An operational scenario to deliver food via PI in favelas

This scenario assumes that some form of PI is already in existence, outside the last mile segment for this particular situation.

1. Information about demand is constantly gathered by the micro-hubs from various sources;
2. Perceived demand (product/quantity) - ordered by a favela micro-hub and delivered in a PI container (s);
3. Supplier packs and requests transfer from the envisaged PI global system;
4. PIC matched to the shipment - the PIC informs directly the supplier and micro-hub about the preliminary timing of the events;
5. PIC arrives at the supplier location (filled and sealed). Departing transport is pre-arranged;
6. PIC is transferred through the PI network, until it reaches the final DC before being sent to the micro-hub;
7. Transport for the PIC (consolidated if possible) is arranged to transfer it from the DC to the micro-hub;
8. Security for the transport towards the micro-hub is also arranged (necessary if the micro-hub is inside the favela);
9. The secured transport is effectuated from the DC to the micro-hub;
10. The micro-hub empties (decapsulates) the shipment, preparing the goods to be transferred to the FiTs (Favela-intra-Transporters);
11. The last mile is executed by the FiT (picks the goods from the micro-hubs and distributes them to the nano-stores);
12. After being emptied, the PIC can pursue its next task, and it is brought back in the PI flows by the departing transport from the micro-hub (and eventually nano-stores);
13. Some PICs, after emptied, may remain (sold by their owners - in the favelas, playing various roles (housing, storage, cold storage, power units, etc.)) - older PICs that are near retirement.

Perceived demand (micro-hub) → Supplier packs → PIC matches shipment → PIC at supplier location → PIC at PI network (DC to micro-hub) → Last mile by FiT

This scenario does not include the usage of the PIC as a temporary stocking unit, from where the micro hub can decapsulate only parts of the shipment, repeating the procedure until the container is emptied.

Assumption: the micro hub is a JIT (just in time) hub, where we want that the containers stay as shortly as possible (they are emptied as quickly as possible). If storage is required, PICs can be sold by the owners, and became (e.g. cold) storage points.

## Conclusion

In Systems Engineering, there are two approaches to assess, test, and validate a complex novel system – like the envisaged PI. The PI claims to achieve global coverage and be affordable for everyone. A simple representation of the functioning envelope of the PI would be defined by two variables: coverage, and economic level of development. A cautious, but rather shielded approach to the current validation of the PI concepts is to start the system working in the areas of this functioning envelope where infrastructure exists and it well established and the economic performance is strong. As design researchers, we position ourselves differently, and we start to design the PI from the fringes of the functioning envelope, where the coverage/infrastructure is weak and the economics and safety/security are poor.

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