Answering the previous questions enables the **development of decision support tools for fertiliser dose, type, timing and placement that does justice to the P supply from the soil**, maintaining sustainable P levels in the soil (ensuring long-term P supply and minimal environmental loss), crop demand and potential yield.

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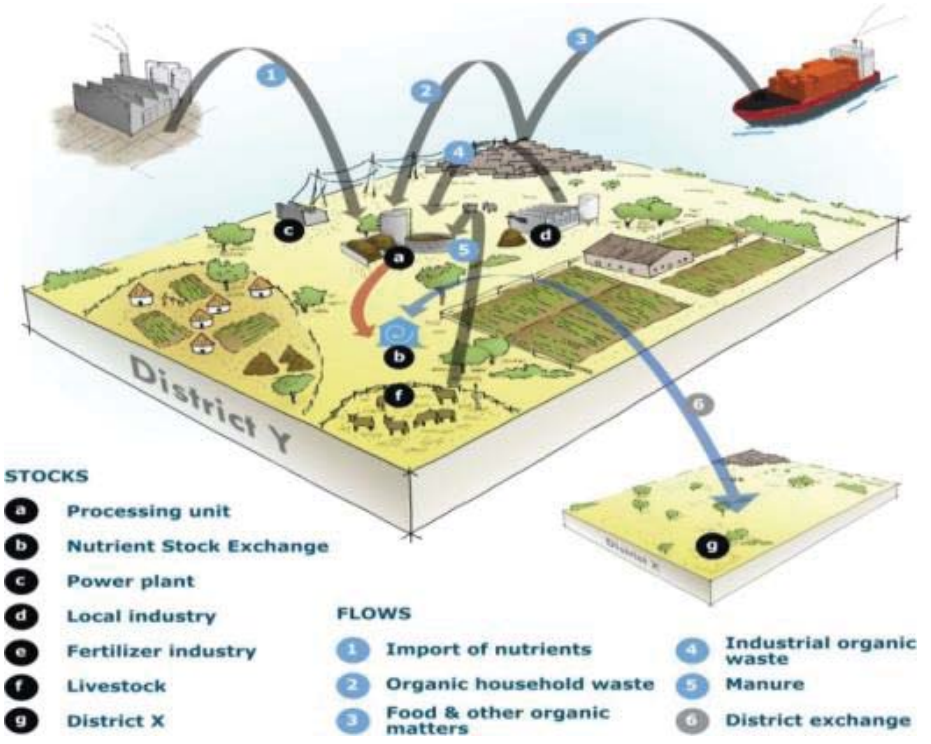
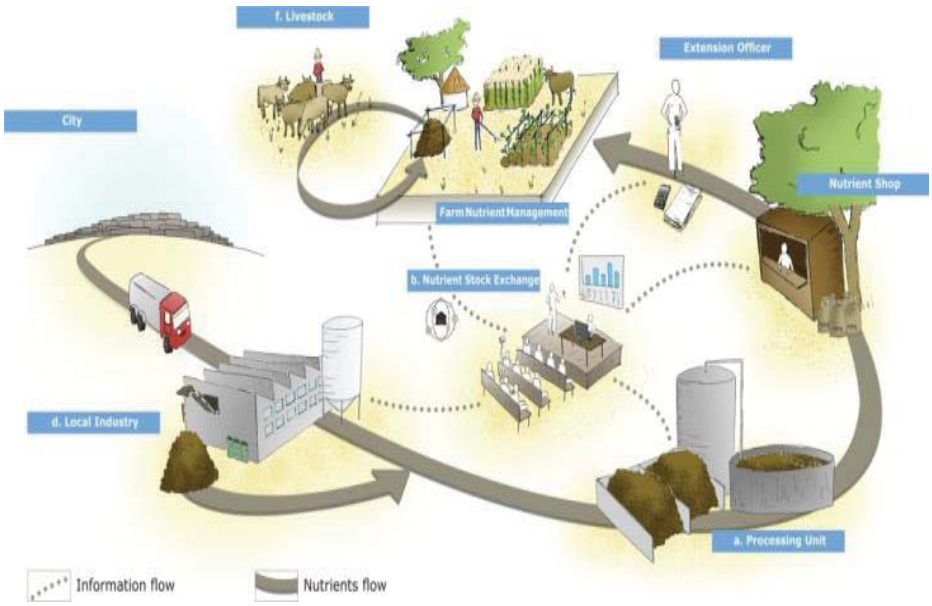
An integrated approach to nutrient availability and use efficiency



Above: Elements of the proposed nutrient cycling mechanisms at the district level. Below: Information and nutrient flows in the proposed nutrient cycling mechanism of the Fertile Ground Initiative.



Every year more than €3 thousand million is lost due to soil degradation. Soil fertility decline that comes with soil degradation limits food production and economic growth. To unlock the potential of soils, nutrients need to be used more efficiently.

This holds in particular for P, because it has **the lowest nutrient use efficiency of all nutrients required by crops**.

Although several pathways of change have been proposed already to increase the productive capacity of soils, new approaches are necessary to cope with the current trends of globalization, urbanization, growing resource scarcity and climate change.

Such approaches should be based on **Integrated Soil Fertility Management (ISFM),** which combines the application of both mineral fertilisers and organic manures with other aspects of agronomic management (seed, crop protection, soil and water management).

Fertile Grounds Initiative

The Fertile Grounds Initiative (FGI) aims for a **coordinated strategy of collaboration between actors in nutrient management at various spatial scales and in time**. It is **based on eight components, which bring together the supply and demand**

of nutrients within a specific geographical area to make optimum use of available nutrients by means of site-specific interventions, supplemented with external imports.

The FGI could make a significant practical contribution to sustainable development in areas with limited soil fertility and P availability. At the same time it turns residual streams into economic assets, thus alleviating environmental problems arising from nutrient emissions near urban centres of the country. he main goal of the FGI is to bring together organic and mineral nutrient flows to **increase nutrient availability, nutrient use efficiencies and nutrient value**, so that new economic activities can be based on the nutrient value chain, and the ownership of nutrients in various forms, and independence of smallholders can be strengthened.

Eight components

The Fertile Grounds Initiative consists of the following eight components:

1. **Inventory**: farmers communicate their nutrient demand, preferably on the basis of their Integrated Farm Plan, and potential suppliers communicate what they can supply, both in terms of amount and quality.
2. **Product formulation and processing**: converting and combining diverse resources, both mineral and organic into valuable fertiliser products.
3. **Brokerage**: nutrients in natural resources and fertiliser products are given a value and a commercial agreement is arranged between suppliers and clients.
4. **Site-specific fertiliser recommendations**: calculating the real nutrient demand, based on e.g. soil and crop data and agro-ecological zones (or projected / expected potential yields).
5. **Trade and logistics**: business case design, nutrient trade and transport.
6. **Capacity building**: farmers, extension workers, brokers and salesmen receive training in best practices for optimal nutrient management.
7. **Institutional arrangements**: cooperating with existing farmers' organizations and/or setting up farmers' cooperatives, defining the role of a nutrient bank, legal and institutional embedding, as well as government and policy support.
8. **Creating an enabling environment for economic growth**: mobilising support for market access, micro-credits, insurances, etc. for smallholders.

Nutrient supply and demand are brought together by brokerage, physical transport and the valorization of nutrients through a Nutrient Stock Exchange (NSE) platform. Nutrient brokerage is based on matching the amount and quality of supply with the nutrient demand of the farming system and the ambitions (i.e. targets) of the farmer.

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Manure as low-hanging fruit

A crisis in phosphorus is not imminent. However, society is not using P sustainably. If that doesn't change, a crisis will come eventually.

Currently identified reserves are about 370 times the annual global production. Although this may seem a large amount, phosphorus is nevertheless **both a finite resource and one that is absolutely essential for life**. But the term "sustainability" implies an indefinite time horizon, and so we are de facto not using phosphorus sustainably.

Concern for future generations makes it morally imperative that we at least **avoid wasting the resource**; that is, eliminating losses that are reasonably easily avoidable. **We should start transitioning to sustainable practices using measures with the best cost/benefit ratio that are technically feasible** and would produce a significant effect on phosphorus use.

Manure recycling

Recycling of manure as a soil amendment/fertiliser fits these criteria and more. It would be up to authorities to require that almost all animal feeding operations use their by-product on farmland in amounts that suit the agricultural needs and no more. **This would require significant changes to practices and infrastructure, but not necessarily new technology**.