A system dynamics approach for examining mechanisms and pathways of food supply vulnerability

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To map the structure underlying **food supply**, we start with **food available for consumption** and work *backwards* to identify the high-level relationships that **cause this food supply indicator to change**. **Consumption** decreases the stock of food available for consumption, food moved to **retail** from the stock of food in processing, and distribution increases it. Figure 3 shows an initial abstraction of **the food production, processing, and distribution supply chain generating food available for consumption**. The amount and characteristics of food products that emerge at the consumer end of the chain are a function of the amount and characteristics of resource inputs available at the beginning and along the chain.

Continuing to work outward from the food chain shows the **connection between the Environment Sector and food production**, in which food production is a function of **resources available** and **resource condition**. Environmental resources needed for food production include **land**, **water**, and **nutrients**. The **condition** of resources can vary from optimum for food production to degraded, affecting the **productivity** of the resource. The condition of resources as well as the amount of resources used is a function of **food sector activities**, including **farming practices**, **pollution from food production**, processing and **transportation**, and **waste** from multiple food activities. Activities in the food sector are also a function of **population** sector elements. The **size of the population** and other characteristics such as **population distribution** and **food preferences** influence demand for food products, type of processing, networks of distribution hubs and retail sites, and consumption. Food sector activities also depend on **labor and labor productivity**, which are population sector characteristics related to population and **health of population**. Food-related human health is, in turn, a function of outputs from food sector activities.

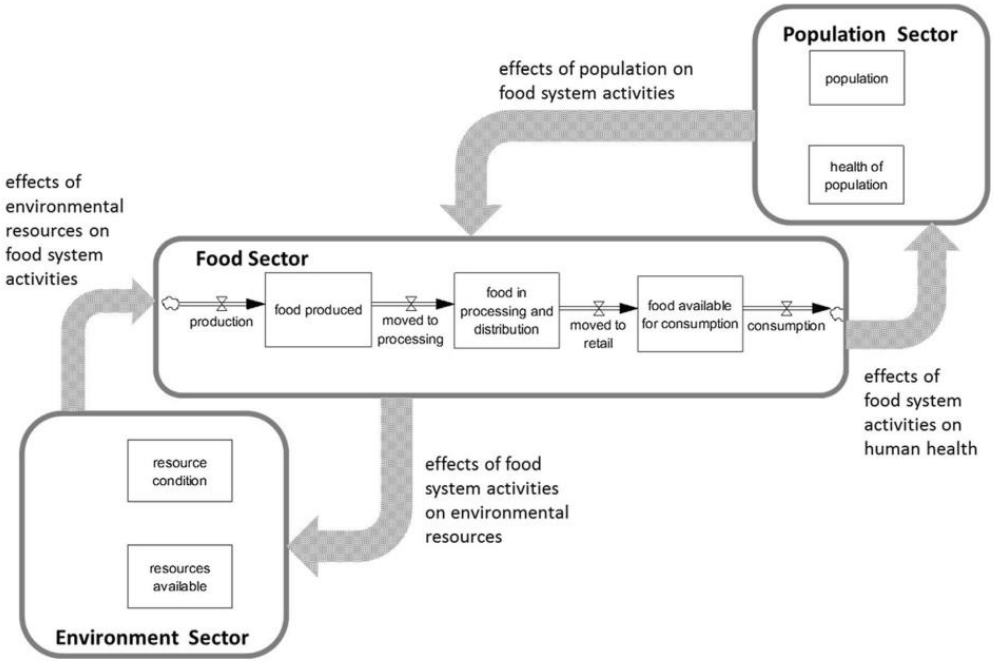

Fig. 3 Sector diagram showing relationships between population, food, and environment sectors