Understanding System Archetypes in South Africa's Food Security Amidst Climate Change and Population Growth

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Introduction

- Food security is a critical issue in South Africa

- Since gaining prominence in policy discussions in 1994, the food insecurity issue in South Africa, has been and continues to be a daunting challenge.

- Gaps exist from data collection due to inadequate standard food security measures to a lack of understanding on the interaction of complex systems such as nexus between climate change, population dynamics and food security.

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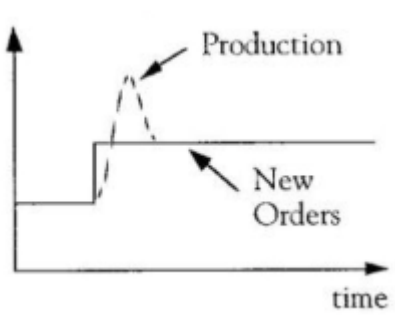
- Our analysis focuses on four system archetypes; 'limits to growth,' 'fixes that fail,' 'shifting the burden,' and 'balancing process with delay' that are crucial in understanding these dynamics.

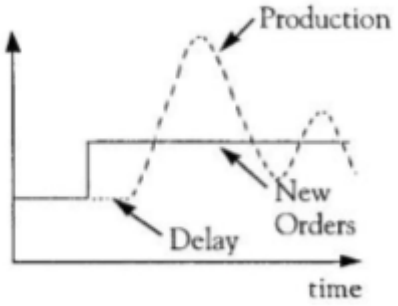
- While past national policies have focused on limiting population growth rate, we hypothesis that other factors such as lack of coordination among sectors (departments operating in Silo’s) , policy implementation gaps and resource mismanagement are the underlying issues contributing to household food insecurity.

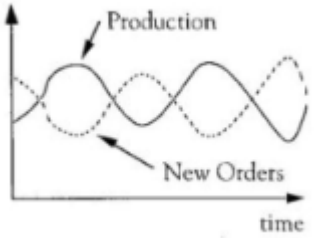
- Short term policies that do not support long-term resilience to climate change were also identified. Relying too heavily on family planning as a tool for food security may foster complacency in addressing the more challenging structural reforms needed for genuine progress.

- We call for research aimed at better coordination among responsible sectors and the development of a standardized food security measure that comprehensively incorporates all dimensions of food security accounting for the broader socio economic, environmental, and structural factors that shape food security in South Africa.

Definition

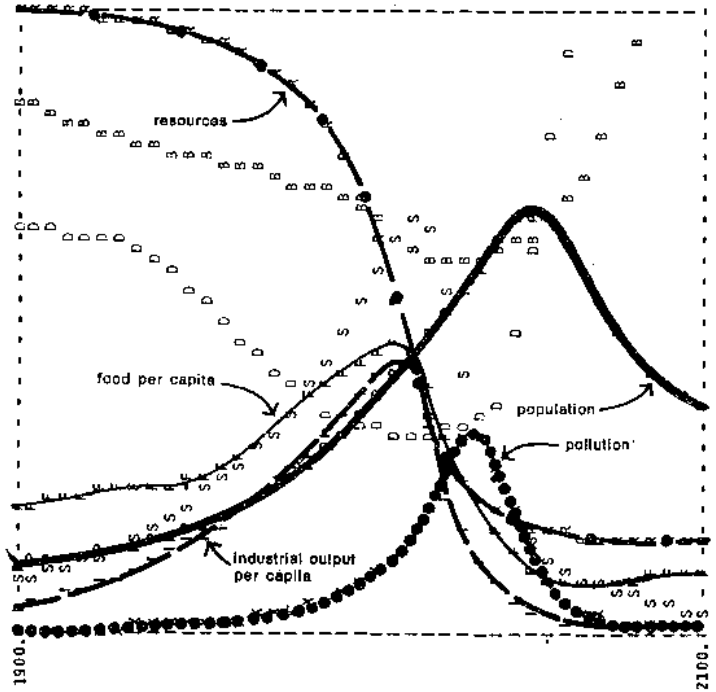






Source: https://thesystemsthinker.com/balancing-loops-with-delays/

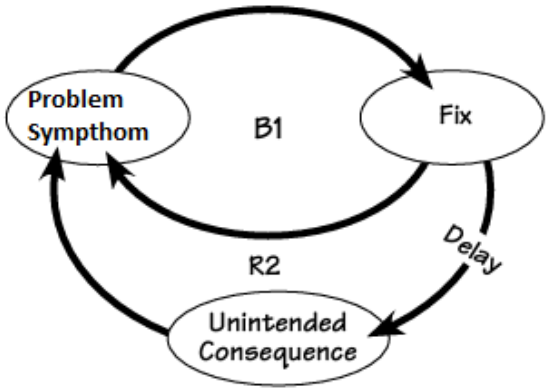
Figure 35 WORLD MODEL STANDARD RUN



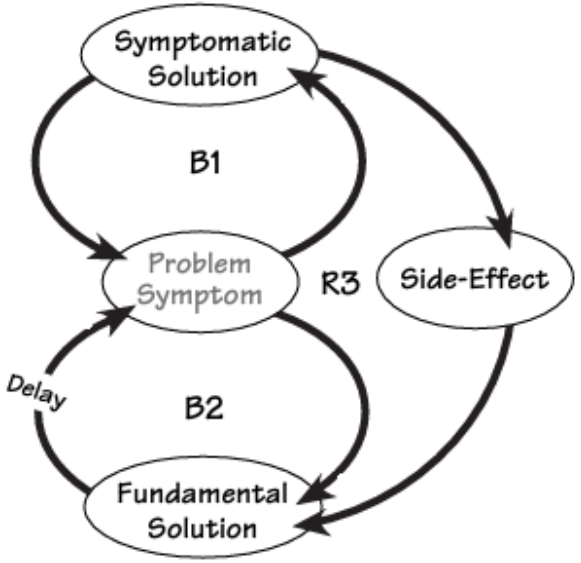
World3 model, developed in the 1972 book *The* ***Limits to Growth*** by Donella Meadows, Dennis Meadows, Jorgen Randers, and William Behrens.

Source: https://www.resilience.org/stories/2022-02-24/the-limits-to-growth-at-50-from-scenarios-to-unfolding-reality/

Definition



Better before worse: A solution that is effective in the short term can lead to unforeseen long-term consequences, often necessitating increased reliance on the same solution. Looks at the 'quick fix' without taking time to understand the underlying issue.



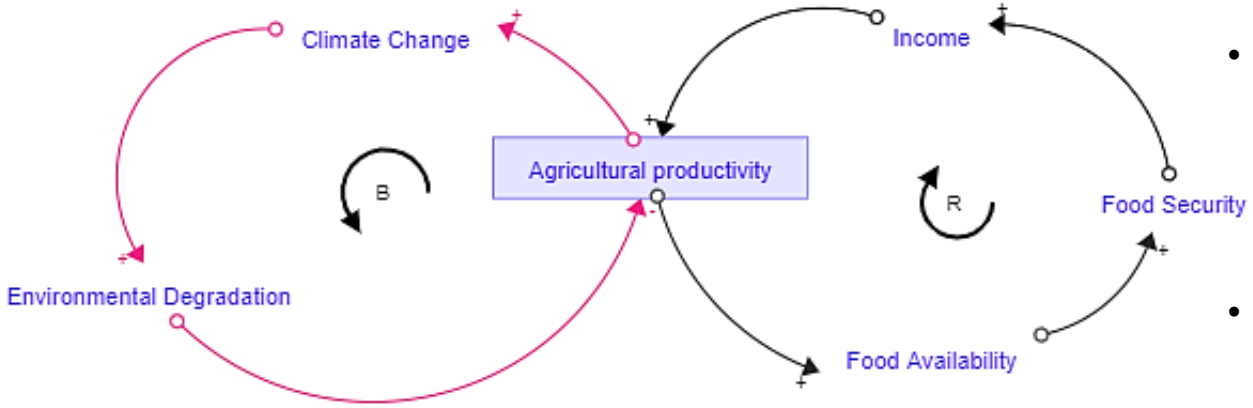
short-term solution is implemented to address a problem. However, this approach provides only a symptomatic fix rather than a fundamental resolution.

This leads to two significant consequences (side-effects):

i. **Diversion of Attention: It shifts focus away from the underlying or root cause of the problem.**

ii. **Dependence on the Symptomatic Solution: It fosters reliance on the temporary fix, undermining the effectiveness and viability of a more sustainable, long-term solution.**

1. Limits to Growth



- The "Limits to Growth" archetype occurs when growth is initially positive, however, it eventually slows or reverses as it will reach a limiting factor, hence it is characterized by reinforcing and balancing loops.
- This archetype is evident in the relationship between agricultural productivity and environmental degradation (Alhassan 2021). While efforts to increase agricultural output can initially boost food availability and rural income, these gains are eventually limited by environmental degradation, soil erosion, and climate change (Fig.9).
- Nearly 91 percent of South Africa's land is prone to desertification and 60 percent of its land is degraded (Mani et al. 2021). Soil degradation is worsening across communal croplands and grazing areas, with sheet and gully erosion affecting around 0.72 million hectares, and water erosion impacting over 70% of the country, with Northwest being one of the susceptible Province.
- Without addressing these limiting factors, efforts to enhance productivity may become futile, leading to stagnation or decline.

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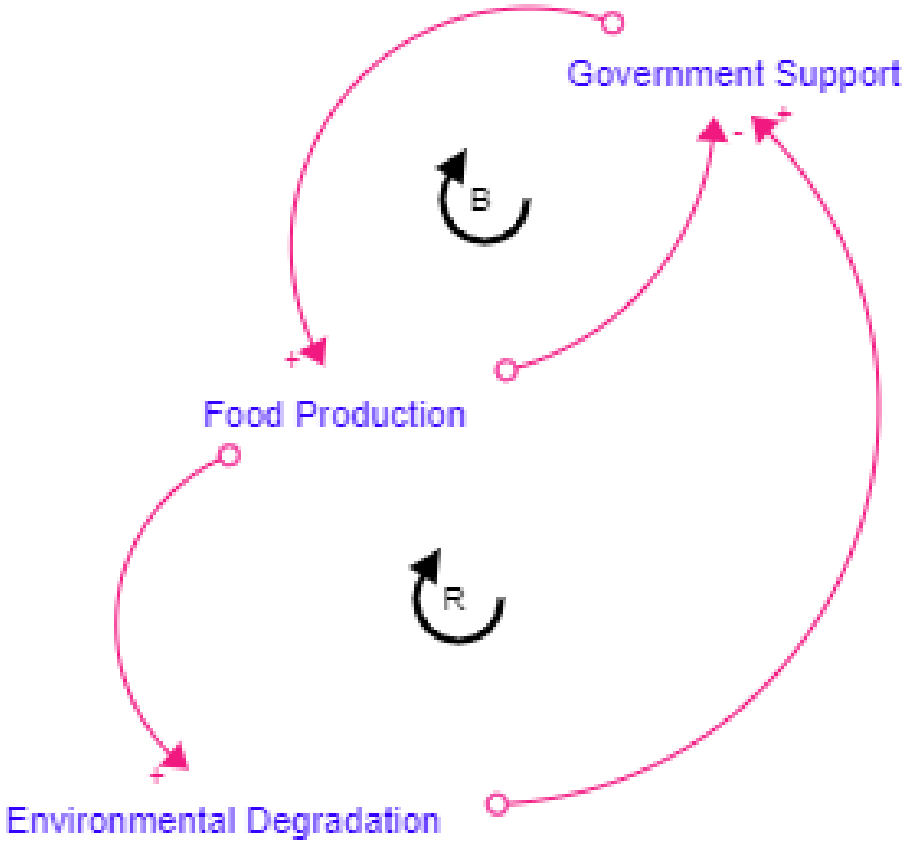
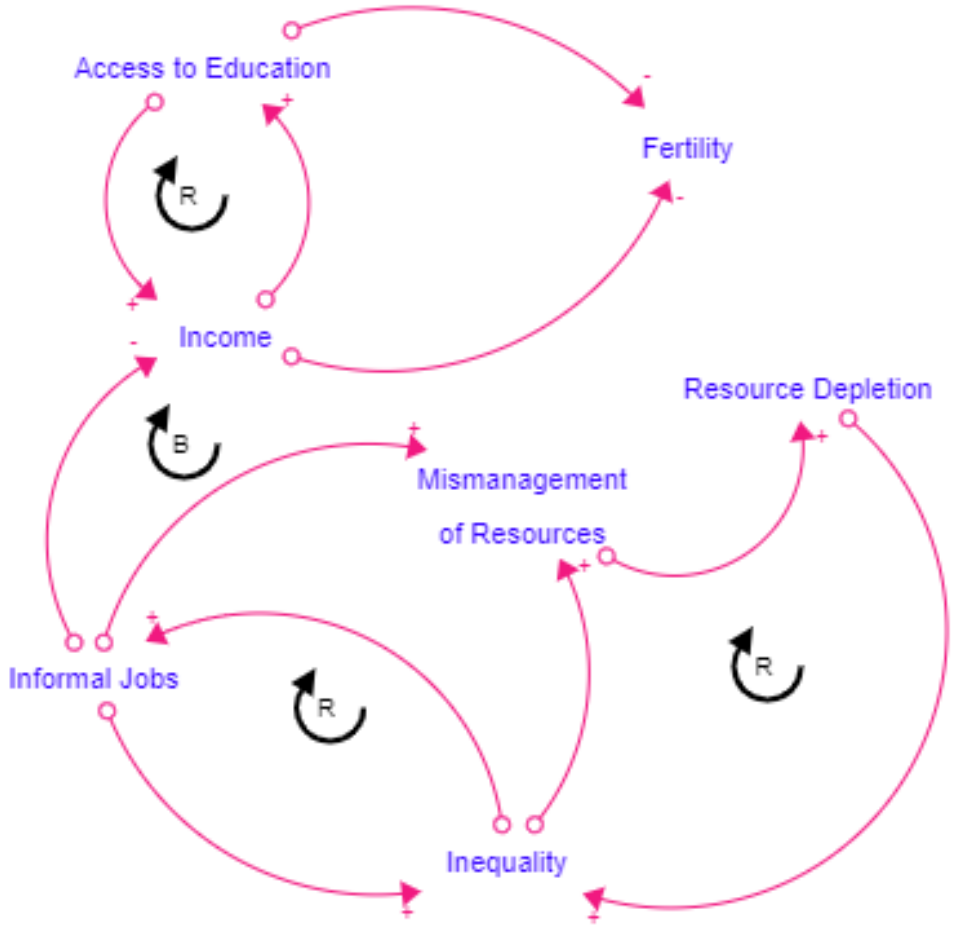
- Due to climate change cereal production in South Africa is projected to decline by 20 percent by 2030 (Carroll et al. 2018). The decline in food production in South Africa has resulted in food insecurity, rising food inflation, and an increased reliance on food imports (Baptista et al. 2022, Carroll et al. 2018, Tekce and Deniz 2016, Sabola 2024).

- The need to invest in sustainable agriculture while ensuring continuous productivity will be the challenge for policy makers.

2. Fixes that Fail



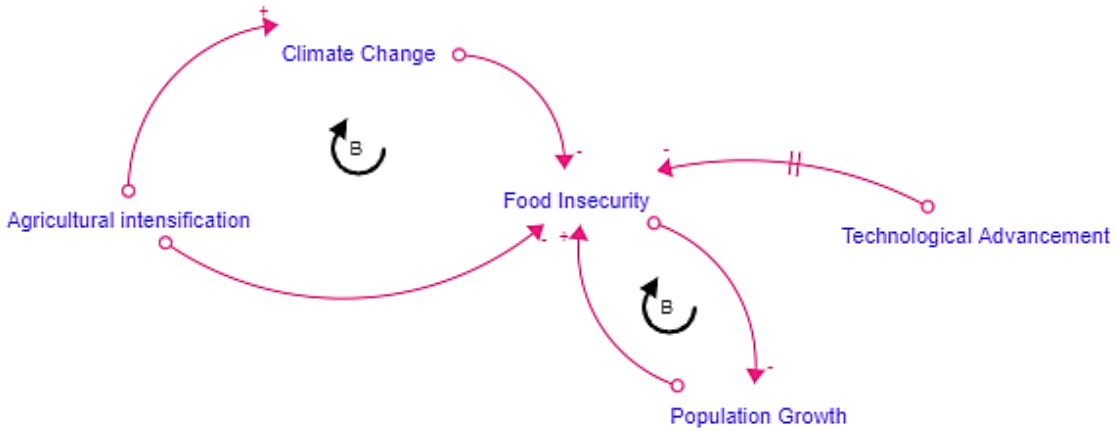
- "Fixes that Fail" occurs when a solution temporarily solves a problem but eventually exacerbates it, creating a worse situation in the long term. Fixes that fail archetype can be found in different scenarios.
- One is visible in the use of short-term agricultural intensification techniques that increase yields temporarily but lead to long-term soil degradation and reduced productivity.
- Furthermore, reliance on migration or urbanization as an economic solution may provide short-term relief but ultimately leads to increased environmental pressures and reduced rural resilience. Another challenge is visible in the land distribution policies applied. The Northwest Agricultural Department used initiatives like providing agricultural food production packages, support to backyard production through supporting with seeds, garden tools and farm animals. These supports, although important, are band aid solutions which might even worsen the food insecurity challenges. Without the appropriate skill development including environmental and economical, self-sufficiency will be eroded.



3. Shifting the Burden

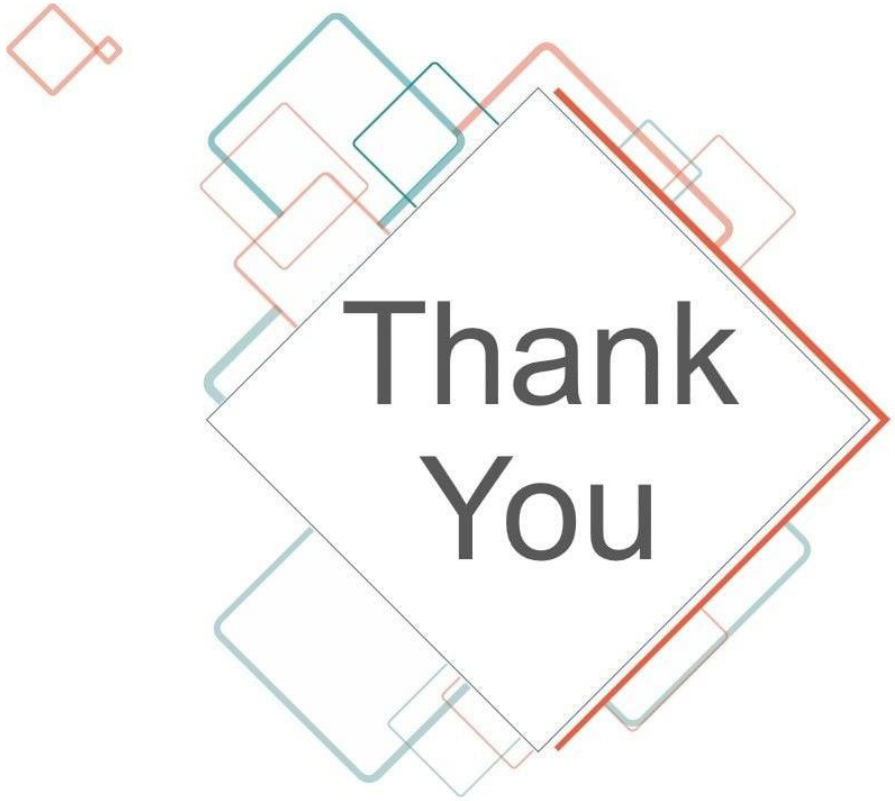
- Shifting the Burden archetype relates to the Fixes that Fail archetype as it occurs when a problem is addressed by a symptomatic solution rather than addressing the root cause, leading to dependency on the short-term fix and the deterioration of the underlying issue.
- This archetype is seen in the reliance on government subsidies or external food aid to address food insecurity without tackling the underlying issues of environmental degradation, poor land management, and lack of investment in sustainable agricultural practices.
- Over time, this can lead to a dependence on aid rather than building long-term resilience. Although policies of population growth strive to have lower population growth rate to reduce the stress on natural resources such as water, the root cause of resource depletion lies in the mismanagement rather than high demand attributed to population growth in South Africa.

4. Balancing process with delay



- Actions are taken in response to delayed feedback in this archetype.
- Food insecurity exists because of policy gaps and extreme climate events such as drought and floods, putting pressure on existing food production systems. Efforts are made to boost food production through various means, such as technological advancements, policy changes, or expanding agricultural land. Initiatives to support small-scale farmers and increase agricultural skills and employment take time to implement. During this period, food insecurity can persist or even worsen due to the delay in the balancing process.
- Short-term measures to increase food production might lead to environmental degradation and exacerbate climate change, creating further long-term challenges for food security.
- Over time, as the initial measures take effect, food production may increase, helping to balance the food demand. However, the delay and the secondary effects might cause oscillations in food security and environmental health before a new equilibrium is reached. Hence, anticipating delays can help mitigate short-term negative impacts. Furthermore, short-term solutions should be designed to avoid long-term environmental damage. Sustainable agricultural practices can help balance immediate food needs with long-term climate resilience.

Comments and suggestions are



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