Dealing with Uncertainty: System Dynamics Approach for Modelling SA's Response to COVID-19

Setting the scene
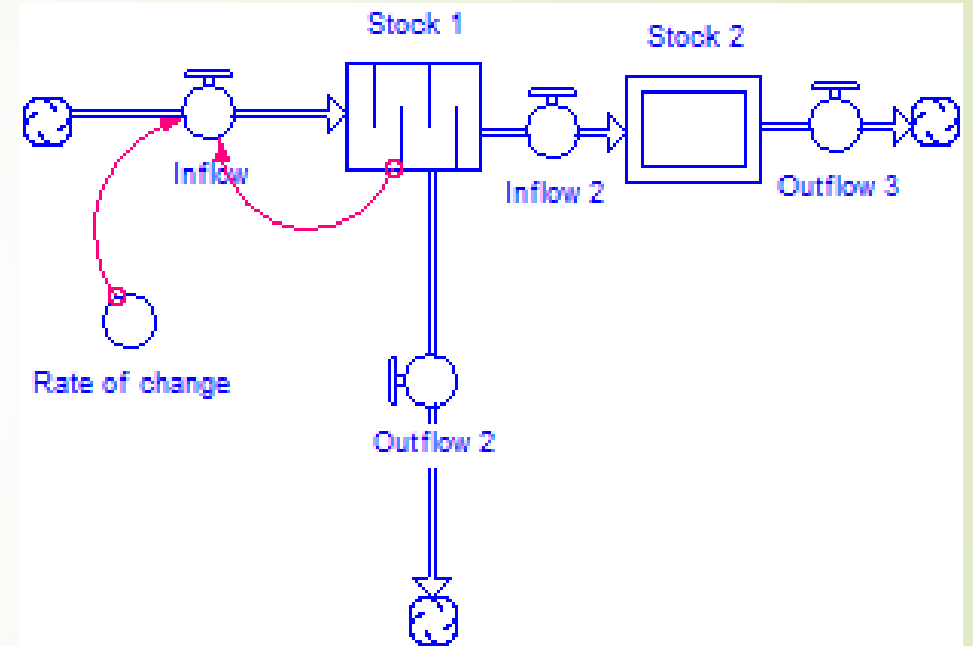
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In this presentation

- Background to COVID-19 Modelling in SA

- What is Systems Dynamics Modelling

- Basics of Systems Dynamics Modelling

- Why Systems Dynamic in modelling SA Response to Covid-19 ?

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Background to Covid-19 Modelling in SA

- Models have been referred to, in justifying governments intervention on COVID-19

- However these models have not been put in the public domain and as such have not been internalised or exposed to critique or engagement.

- This work is an attempt to put the model developed and used in response to Covid-19 in public domain to allow for scrutiny, engagement, and improvement

- The authors are, mindful that, "All models are wrong, but some are useful," (John Sterman, 2002). Hence the importance of this model lies in its usefulness.

What is System Dynamic Modelling

- A unique modelling approach that develops models for complex situations characterized by:

  - Changes overtime – dynamic
  - Non-linearities
  - Feedback effects
  - Time lags

- The spread of pandemics like COVID-19 fall in the category of a complex systems with the above characteristics

- A key assumption of SD modelling is that it is the structure that determines behavior. If you change the structure, observed behavior will change.

Basics of SD Modelling

1. Develop on a _mental model_ of the systems\processes behind the phenomenon of interest to be modelled – guided by _Systems thinking_

2. Capture the mental model in form of, causal loops, and then stocks and flows

   ▪ Causal loops –pictorial representation of relationships and feedbacks between key variables of a system

   ▪ Stocks are accumulation of overtime – What is changing with time

   ▪ Flows are rates of change of the stocks

3. Quantify the model through defining start conditions, rates of change and input values of other model parameters

4. Do the base run of the model – ideally it should replicate the observed trend of the phenomenon of interest

5. Use the model to simulate different scenarios- certain or uncertain – through key policy parameters

Why SD Approach in modelling SA Response to Covid-19

- Provides a means to capture complex relationships and feedback effects within a set of interrelated activities and processes (Vennix, 1996, p.21).

- Its presentation has a user-friendly interface that encourages non-academics to internalize the logic behind the model – *Hence can be done with a multi-disciplinary team of experts*

- It allows the use of quantitative and qualitative data; hence, it is not limited in its use when quantitative data is unavailable.

- Specialised software in SD modelling allows scenario simulations,

- Approach has been previously used in the modelling of pandemics like flu pandemic of 1918 - Kermack and McKendrick (1927); Mansouri (2020); SD Society (2020)

Now to the presenters of the SA Covid-19 Model using SD