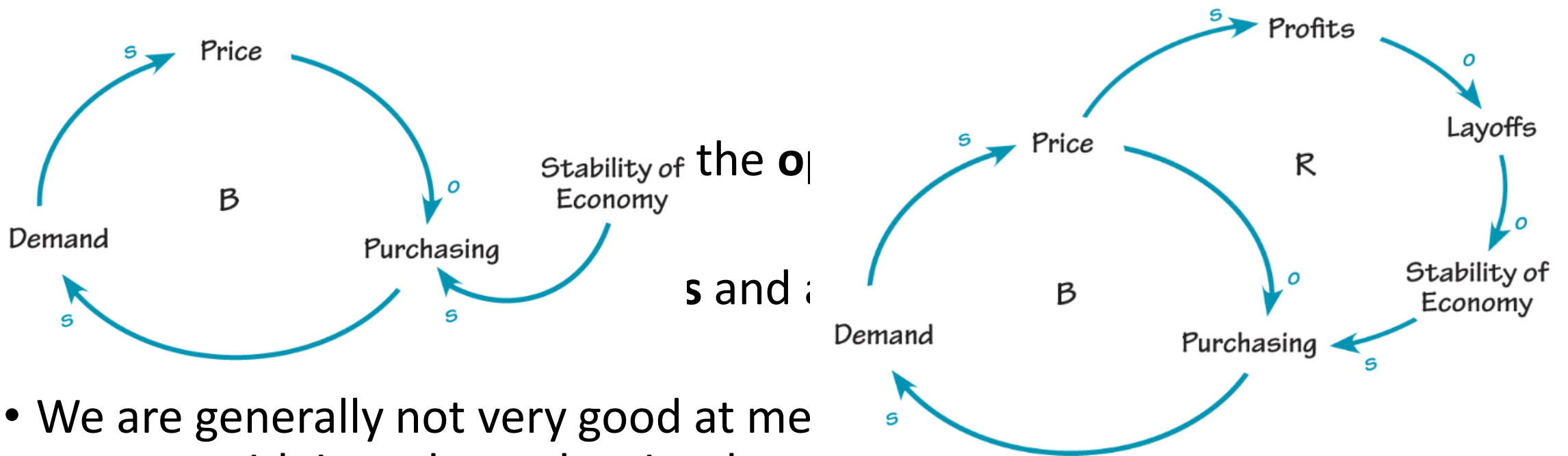
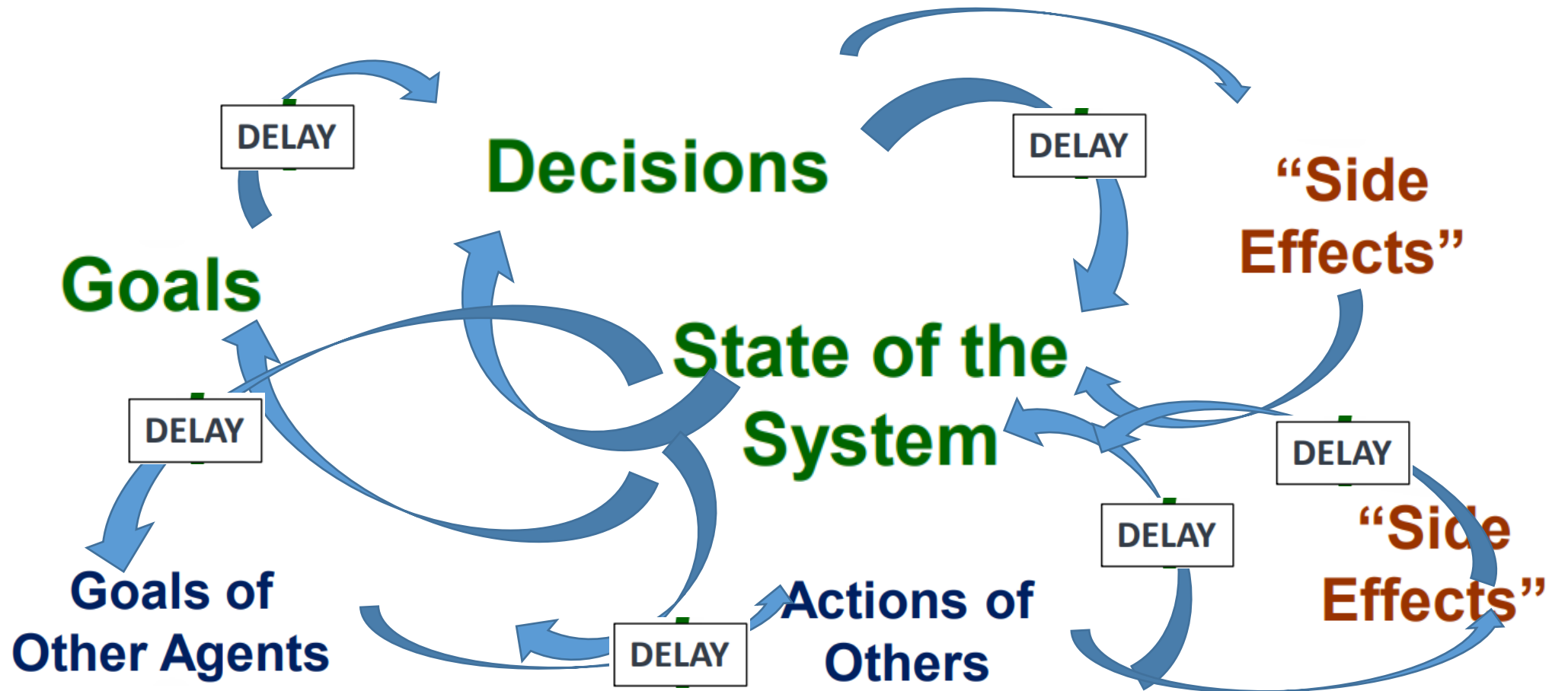


Mental models in System Thinking



- We are generally not very good at measuring systems with interdependencies, lots of variables, and delays.
- For example, in the model above, our understanding changes when we expand the boundaries to include profits and layoffs.



- Making a choice today that affects your system and achieves that goal within that open loop thinking model, ultimately can come right back around and affect that original input again.
- This is the fundamental concept of systems level thinking.
- **No decision you make exists in isolation.**

- **So what is a system ?**

- A system is a **set of inter-dependent parts** **sharing a common purpose**.
- The performance of the whole is affected by each and every one of its parts.
- Social and Economic Systems are highly complex systems:
 - Dynamic
 - Tightly coupled
 - Governed by feedback
 - Nonlinear
 - Limited Information • Ambiguity and delays in cause and effect

- So when we talk about systems thinking and **system dynamics**, it's really a **framework to help close the loops [feedbacks]**.

- **Mental models in System thinking.**
- The decisions we make right now, we simulate it, expand it, and see **how *those decisions affects us in the future when we have the outcomes.***
- How can we bring feedback into account? → **Simulation.** → cheaper, quicker.

- We bring many deep-rooted assumptions, strategies, ways of looking and guiding ideas to whatever we do. These are known as mental models in systems thinking.
- 'Mental' because they exist in our minds and drive our actions, 'models' because we construct them from our experiences.
- They are our theories in use, based mostly on observation and experience, but with a sprinkling of received wisdom and a dash of hope.

- We use them to discriminate and decide what is important and what is not.
- We may **mistake our view for reality.**
- Ex: illusion diagrams (pictures).

- **How did we build them?**
- We make our mental models partly from our social mores, partly from our culture and partly from the ideas of significant adults in our childhood.
- The rest we construct and maintain from our experience of life in **four main ways:**

- DELETION :
- We **select** and **filter** according *to our moods, interests, preoccupations and general alertness*.
- We **delete information** and **form our ideas** from what we notice.
- There is always other information, **but it carries no significance** for us, so for all intents and purposes it is not there.
- Deletion also maintains our mental models once they are formed.

- CONSTRUCTION
- We **see something that is not there**. (*Construction is the mirror image of deletion*) Seeing is believing.
- **Ambiguity is almost guaranteed** to induce construction. → **In the most obscure or random events.**
- **Read the following example:** The experiment shows how easy it is to **construct plausible explanations** and *mistake the connections we make with the actual events.*

Imagine for a moment you are a subject in this experiment. You sit in front of the machine and you have to rely on your memory because you are not allowed to keep written notes. There are 13 trials, each consisting of 25 attempts. During the first 10 trials, you experiment with various combinations and get about half of them right. Then for two trials you do not get any right, so you revise your theories. After that, you are right every time. You feel proud and satisfied – you have cracked the code. You backtrack in your mind and get ready to tell the experimenter the winning sequence and how you found it.

Then the experimenter confounds you – the whole experiment was a set up. For the first 10 blocks, the buzzer was pre-set to sound 50 per cent of the time at random intervals. Then two trials of silence, regardless of what you did. For the last 10, it was pre-set to sound every time. In other words, there was no connection between what you did and your success or failure as signalled by the buzzer. Many subjects in this experiment were so sure they had discovered the sequence, they did not see how it could have been random. It fitted in with their strategy so perfectly that they thought the experimenter was lying.

- DISTORTION
- Distortion is **how we change our experience**, amplifying some parts and **diminishing others**. It is the basis of creativity as well as paranoia.
- When we distort events, *we give more weight to some experiences* than others. It is not a bad thing to do, but it can lead us astray.
- For **example**, many gamblers continue to believe that **they can and will win despite the fact they keep losing**. They do so by reframing losses as 'near wins'.

- Jealousy is a good example of how distortion can be limiting and painful. *A jealous person can distort all sorts of everyday, innocent events into suspicious, threatening and painful events.*

- GENERALIZATION
- Using generalization, we create our mental models by taking one experience and making it represent a group.
- For **example**, a child sees how their parents treat each other and generalizes to make a mental model of how men and women treat each other.
- Without the ability to generalize, we would have to work out every problem from scratch.

- The **danger** is to take an unrepresentative example, generalize to many other similar examples.
- For **example**, a manager may believe consultants are useless in his industry, because he has generalized from one bad experience with a consultant.

- There are **three main factors** that can cause us to misinterpret our experience so that it seems to provide reinforcing feedback that strengthens our existing mental models –
 - regression,
 - time focus and
 - one-sided events.

- REGRESSION
- Regression is a statistical principle that can lead to mistaking a connection for a cause.
- Generalizing from this will make it worse.
- For **example**, suppose today is exceptionally sunny and hot. What are the chances of tomorrow being equally hot? Not so good.
- *Any extreme experience is more likely to be followed by one that is closer to average.*
- Very tall parents tend to have less tall children.

- events tend to regress towards their average value.
- For example, a poor performance is usually followed by a better one without a reward as a motivation to do better or a punishment as a deterrent for slacking.
- *What is taken for evidence for the efficacy of rewards and punishments is mostly due to the regression principle.*

- TIME FOCUS
- Events are often mistaken as reinforcing feedback because **no time limits have been set**.
- We do A and expect B to happen.
- Whenever B happens, whether it be hours, days, weeks, months or even years afterwards, *we take it as the effect of A and as proof of the connection.* → **It is NOT time focus.**
- Read the example →

- Many managers believe that people can be motivated to work creatively by financial rewards. It is easy to get evidence for this belief- reward someone and then wait for the creative work.
- Whenever it happens, whether today, tomorrow or in a month's time, it can be used as evidence to confirm the belief.
- If it does take some time, then a handy back-up belief is something like, 'It takes time for people to see their own best interests.'
- The regression principle almost guarantees they will come up with creative work sometime in the future and it will not necessarily be connected to the reward.
- In fact there is considerable evidence that rewards are motivating only on very limited occasions.

- ONE-SIDED AND TWO-SIDED EXPERIENCES
- This means you have set up a one-sided experience - **only one result is significant and noteworthy.**
- For example, a manager may be really enthusiastic about a new advertising campaign. When sales eventually pick up, they are pleased and remember the upturn.
- *A person who only looks for evidence in one-sided experiences is the sort of person who will wonder why someone always answers the telephone when they dial a wrong number!*

- An **example of a mental model** that sets up **one-sided, unfocused** experiences is: *'People will only change when they are ready'*.
- **One-sided, focused** experiences can also confirm existing mental models. One **example** would be : *looking for an upturn in sales in the next quarter due to a new incentive scheme.*

- **Two-sided experiences** are those that are memorable regardless of what happened, favourable or unfavourable.
- Ex: Going on a date, taking a holiday or gambling on the stock market are all two-sided events.
- *All the possible outcomes evoke the same intensity of emotion, or even the same emotion.*

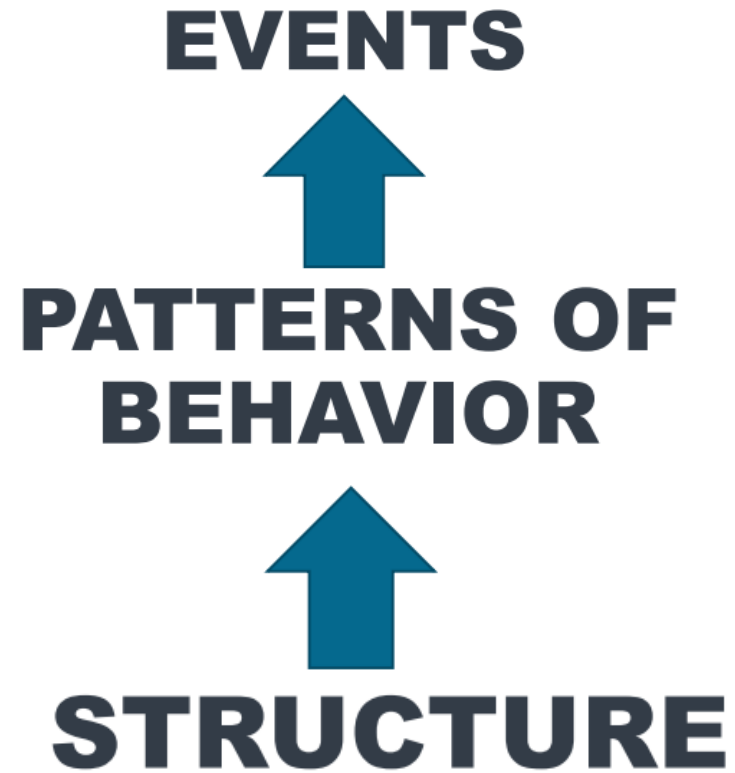
- Puzzle:
- Three closed boxes are labelled 'Apples', 'Oranges' and 'Apples and Oranges'. Each label is incorrect. You may examine only one fruit from each box (and no feeling around allowed!) How many fruits must you examine in order to label each box correctly?
- Pick a fruit from the box labelled 'Apples and Oranges'. Suppose it turns out to be an apple. What can you say about what is in the box? Not much directly, but you know the box is not 'Apples and Oranges' because all boxes are wrongly labelled.
- You know it is not 'Apples' because that would not contain an orange. Therefore it must be oranges. You know all the boxes are wrongly labelled, so switch the labels of the other two boxes and you have the answer.

- **Mental modelling in 4 steps: <framework>**

1. Elicit and articulate **mental models** and impact of social and organizational structure
2. **Expand** mental models by explicitly accounting for feedback
3. Test and improve mental models and structure via **simulation**
4. Develop **shared** mental models and more effective organizations.

- Importantly,
- **structure generates behaviour** → **actions** that people take are possible, feasible, and rational because of the environment in which they exist.
- However, figuring out what those inputs and outputs are and how people convert that information is difficult and should not be casually assumed away. (ex: input to PC/person and get an output, multiple factors may affect)
- And that actually then goes into that → **mental models matter a lot.**

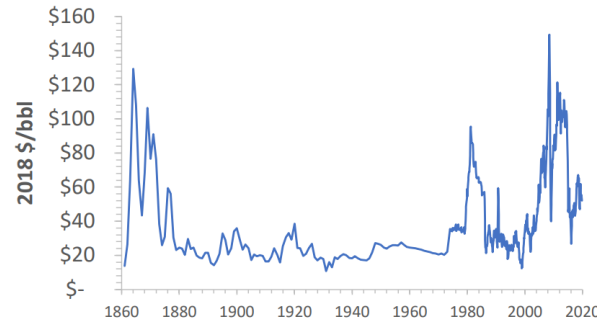
- Structure Generates Behavior:



VISIBILITY

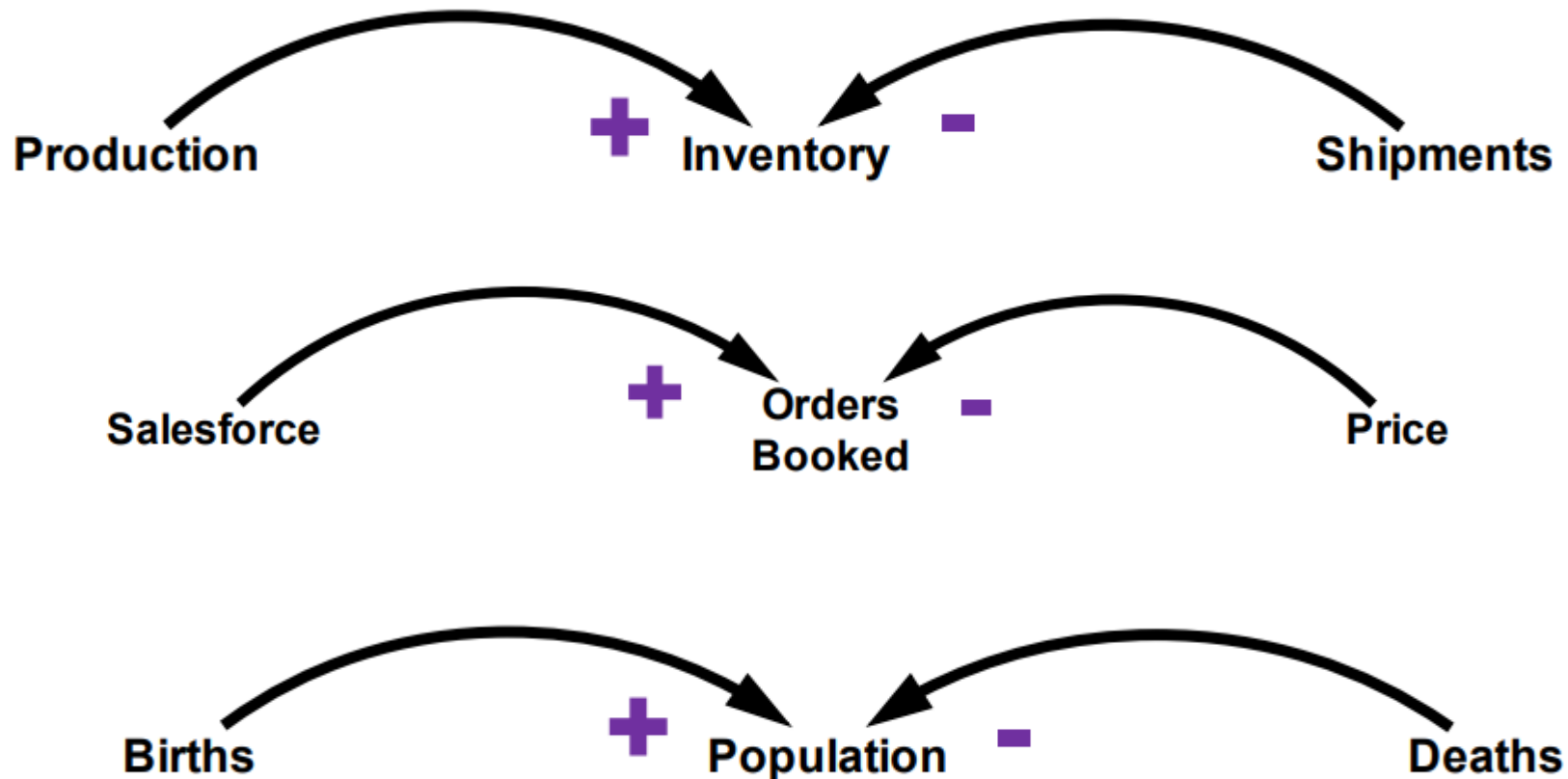
- Events: Oil prices keep rising — due to war.

- Patterns of behavior:

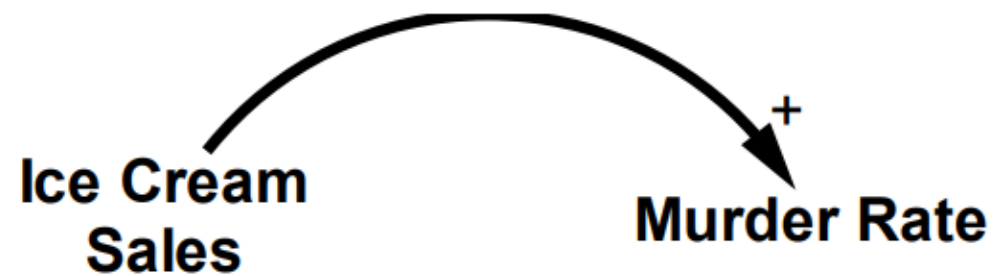


- Structure:
 - Physical structure: Stocks and flows
 - Information availability: Access & transparency
 - Mental Models : Misperceptions of feedback

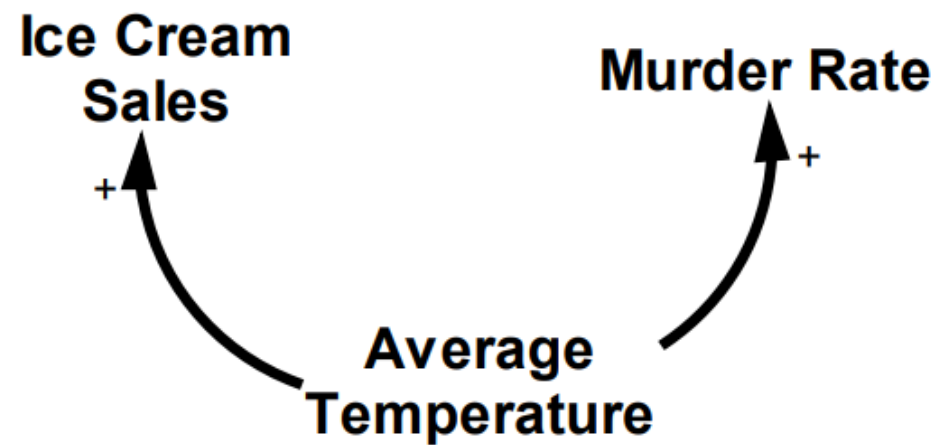
- **System thinking tools:**
- causal link → So causal link is simply saying, if one thing changes, another thing changes.



Incorrect!

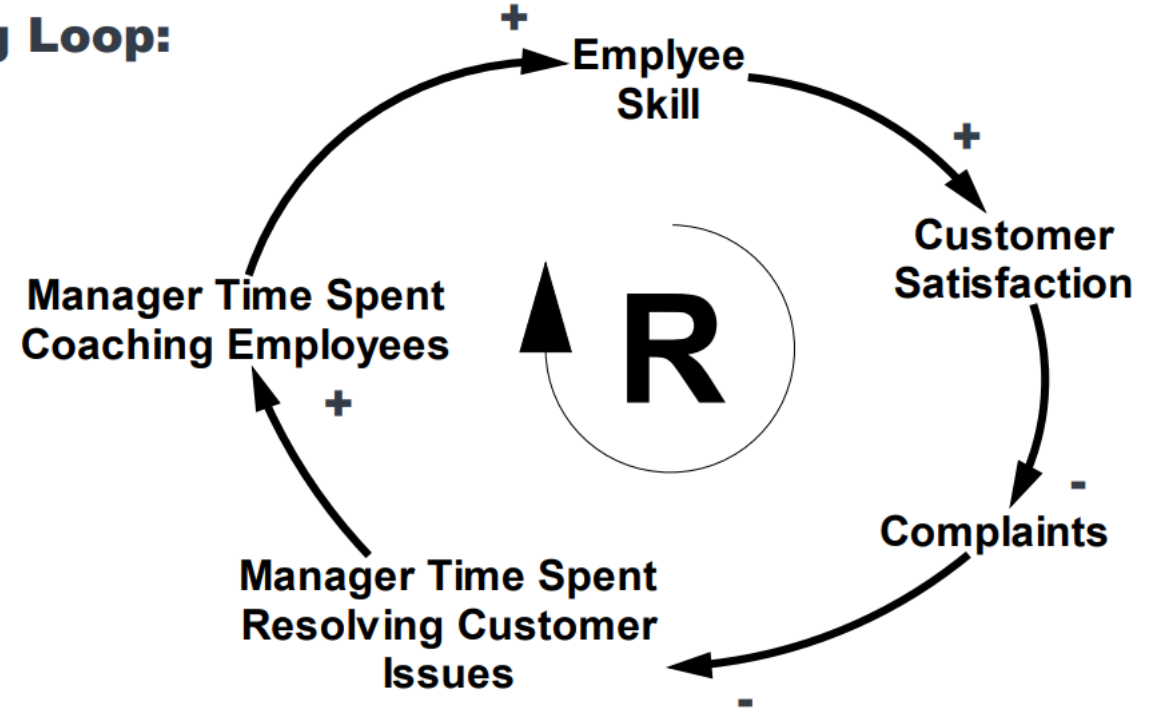


Correct

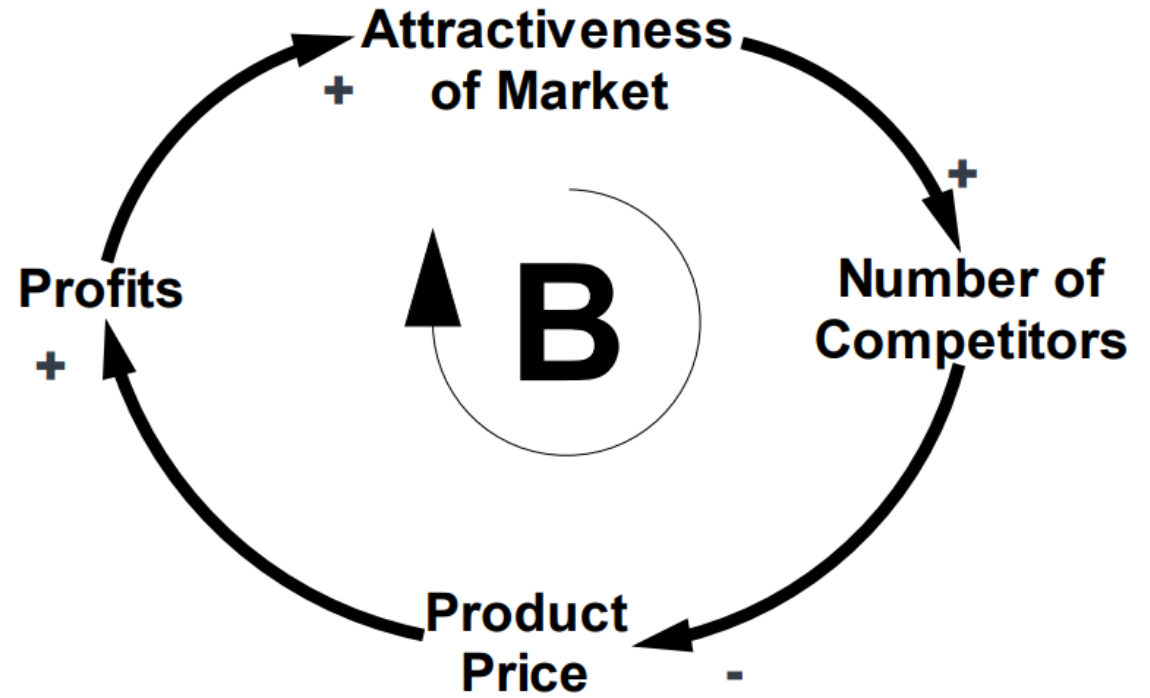


- Bringing it all together into a loop:

Reinforcing Loop:



Balancing Loop:



- Will **Bloom's taxonomy** help in improving the education (teaching, learning practise). If YES: How, Else If NO: Why. Justify from the System Thinking perspective.

Brain Storming Session

- How could the technology be used/implemented (such as smart devices, web) to (i) create awareness and (ii) prevent the pandemic.
- Use system thinking approach (all dimensional suggestions)