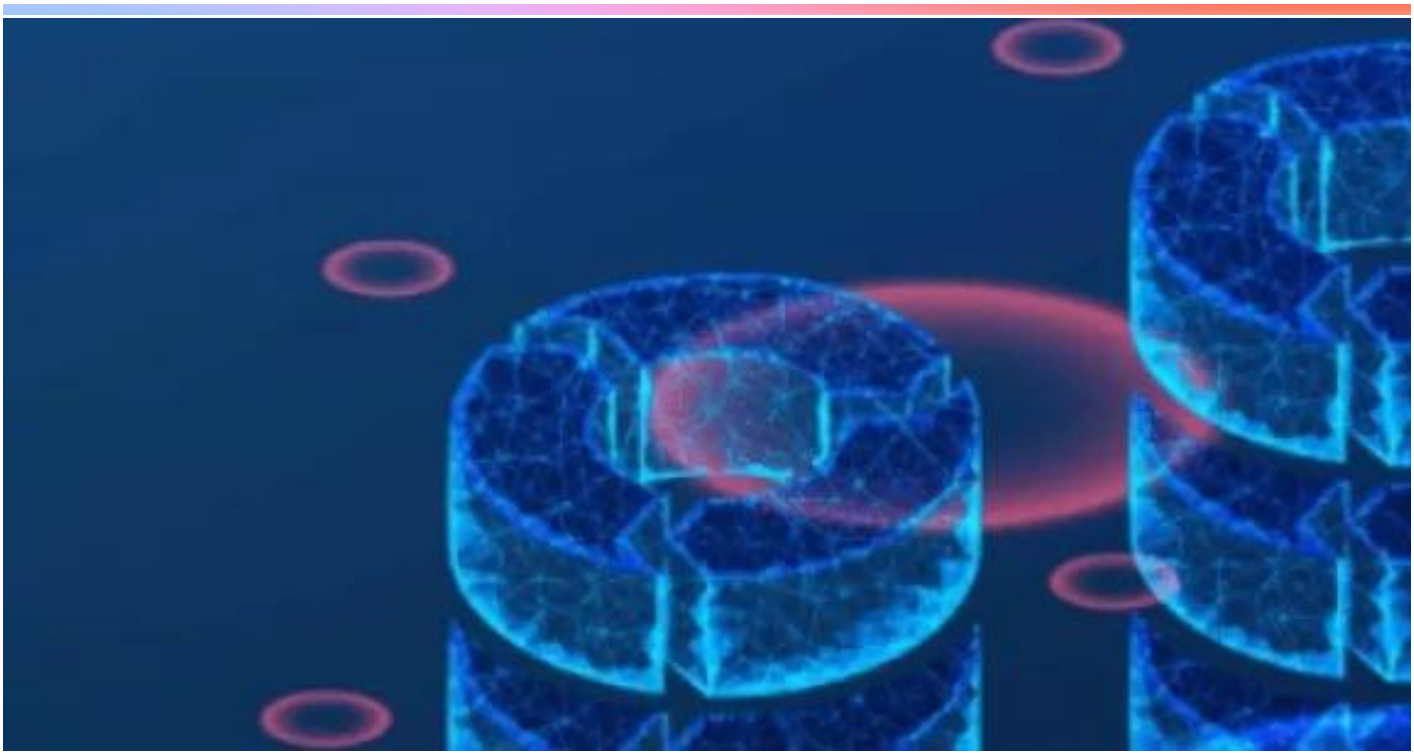


Combining stock and flow variables in a CLD | System mapping – Part 2

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Why a CLD requires more than just causal relationships

In the second part of this series on system mapping, we explore an important question within causal loop diagrams (CLDs): can stock and flow variables coexist in a single system map?

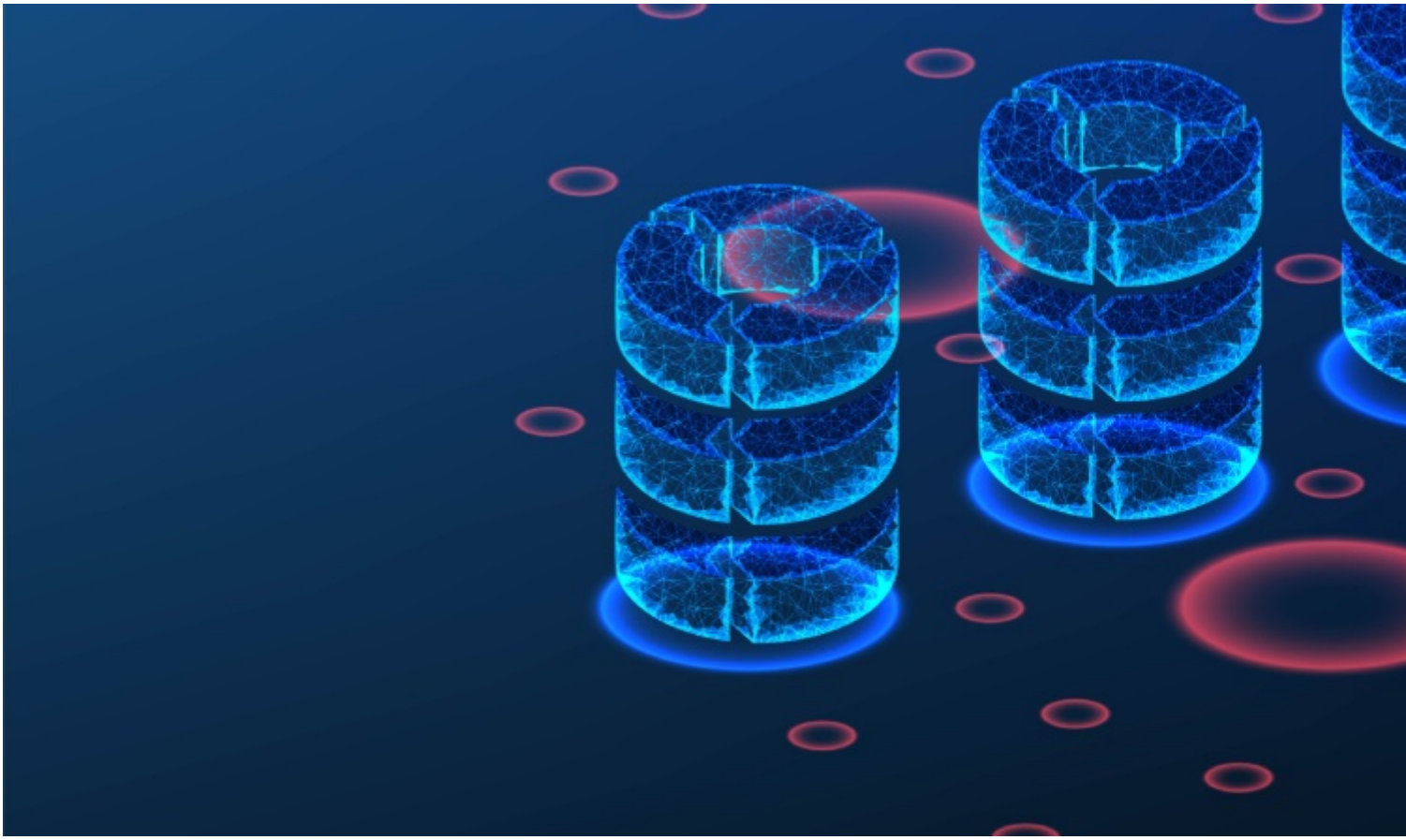
Anyone working with system dynamics will soon come across stock and flow diagrams (SFDs). The distinction is clear: stocks build up over time, whereas flows represent changes per unit of time. Stock and flow diagrams are particularly well suited to simulating behaviour over time, quantifying effects and making delays explicitly visible. In many projects, though, you don’t start with a simulation model straight away. System mapping often begins with a causal loop diagram (CLD): it’s quicker, more accessible and ideal for structuring complex systems and supporting discussions with stakeholders. This soon raises an important question: can stock and flow variables also appear together in a CLD?

Why stock and flow thinking remains important in a CLD too

A CLD is not a simulation model, but it does help to visualise system behaviour. That behaviour is strongly influenced by the difference between what builds up and what drives change. This is why it is often useful, even in a CLD, to distinguish between:

- Stock-like variables that build up over time
- Flow-like variables that express change or activity

In a ReX context, for example, the installed product base, accumulated ReX capacity or market confidence are typical stock-like variables. Such variables give a system memory and make lock-in effects or path dependence visible. On the other hand, there are flow-related variables such as the investment rate, return rate or refurbishment throughput. These drive change within the system.



Some variables behave in a hybrid manner

Not every variable fits neatly into a single category. In practice, some behave in a less straightforward manner. Variables such as adoption rates or failure rates may appear at first glance to be flows, but they don’t function as simple, directly controllable rates. They are influenced by a number of underlying factors, such as design quality, user behaviour, the age of the installed base or accumulated market experience. This doesn’t make such variables incorrect in a CLD. What it does mean, though, is that you should view them as derived or emergent variables: outcomes of broader system dynamics. And that is precisely where an important insight comes in. A good CLD doesn’t need a perfect theoretical classification for every variable. Above all, it should make the following clear:

- What builds up over time
- What drives change

- Which variables are themselves the result of other dynamics

What goes wrong when no distinction is made between stocks and flows

If no distinction is made between stock and flow behaviour, three classic pitfalls quickly arise in CLDs:

- Effects seem instant, whereas in reality they build up slowly
- Feedback loops are interpreted too simplistically
- Derived variables are seen as direct levers for intervention

As a result, what makes systems thinking so valuable is lost: an understanding of delays, inertia and accumulation.

Three practical guidelines for your CLD

1. Make accumulation clear in your naming

Formulate variables in such a way that accumulation becomes apparent. For example:

- Not: investment in ReX ? capacity
- But: investment rate in ReX ? installed ReX capacity

This implicitly makes it clear that capacity builds up gradually.

2. Add delays where logical

Where there is a build-up, delays often occur. Without delays, a CLD can easily give the impression of unrealistic, instant effects. If delays are explicitly visible, the system’s behaviour becomes more realistic and easier to interpret.

3. Treat hybrid variables with care

Variables such as market acceptance, adoption rate or failure rate can feature perfectly well in a CLD. However, they are rarely straightforward points of intervention. They often serve as indicators that deeper systemic dynamics are at play.

When a CLD is no longer sufficient

A CLD remains, in essence, a logical model. Whenever you want to explicitly simulate behaviour, timing is crucial, or multiple accumulations interact significantly with one another, a stock and flow diagram is usually a better choice. This applies, for example, when policy decisions depend on timing, delays or capacity build-up over longer periods.

Takeaway

The key point is not that every variable has to be accurately labelled as stock or flow. It's more important for you to understand how variables behave over time. Some variables build up over time. Others drive change. Still others are themselves the result of broader systemic dynamics. It is precisely this insight that makes a CLD stronger. You get a clearer picture of where the system has memory, where the real leverage lies and why some interventions only take effect later on.

Want to get started with system mapping yourself?

Would you like to explore how system mapping can strengthen your ReX programme? Our experts will be happy to help you make systemic interconnections visible, identify levers and develop scenarios for scalable circular solutions.

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Discover the other parts on system mapping

Part 1: How do you handle conditional causal relationships in a CLD?
Part 2: Combining stock and flow variables in a CLD ? *Current article*
Part 3: System equilibrium and why systems get stuck
Part 4: How detailed should your system map be?
Part 5: Combining working methods and tools in a pragmatic approach

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