# Causal Loop Diagram (CLD)

## Transcript video 2

Video link: https://youtu.be/6oswfgu1gjY

Full resource, see: https://www.ncrm.ac.uk/resources/online/all/?id=20845

 Hi there. Welcome to part two of our causal loop diagram – visualising connections between different parts of a system tutorial. In the first part we went through what a causal loop diagram is, why you might want to build one and also the steps that you would take to build one. In this part of the tutorial we’re going to continue building the different stages of our social, economic and environmental sustainability cod fishery. We’re also going to then reflect on the building process, as well as talk about any further advancements you can make once you have your causal loop diagram.

 So, this is the environmental pillar of sustainability part of the system we built in the previous tutorial. Just as a reminder, you can see how spawning conditions affect birth rate, which influences the juvenile cod population, which then influences the recruitment rate, adult cod population, and these are all influenced as well by the death rates and mortality factors through fishing, predation and other mortality factors, as well as the crustacean population, because that’s their food. You can also see how there is reinforcing feedback loops and balancing.

 So, since we’re considering the socioeconomic and environmental pillars of sustainability, this slide has then expanded the system to include the social part, so we can also see the connections between the environmental pillar and the social pillar. So, here you can see how marine mammal populations, such as seals, and shark population may have a positive influence on tourism. This is because people may travel to see the seals or sharks. Also fishing villages likely has a positive influence on tourism because a lot of people like to go to the coast and see fishing boats. You can also see how the fishing activity has a relationship to the fishing mortality rate. This is as fishing activity increases, the fishing mortality rate increases and then the adult cod population decreases. Fishing activity also provides environment employment, which is another social benefit. The fishing activity also influences the processing industry, the supply chain, the hospitality sector and the direct consumption for us humans, which also impacts the nutrition and consumer demand. These all then influence the fishing activity again because if consumer demand is high, fishing activity is also high, which gives rise to this reinforcing loop here.

 So, this slide has now expanded further to show the economic pillar of sustainability. We can now see the connections between the social and economic pillars, which is often quite strong in any circumstance. So, you can see here how tourism has a positive impact on local economy and then local infrastructure, such as hospitality sector. You can also see how the fishing activity impacts the supply chain and the market price, the local price and the world price, as well as also how employment provides income and jobs. We can also identify a balancing feedback loop here and a balancing feedback loop here, and a reinforcing feedback loop here.

 In this part we’ve expanded the system to include regulation, which often acts on the social, economic and environmental part of the sustainability of a fishery. So, here we can see that we have HPMAs and MPAs. These are highly protected marine areas and marine protected areas, which then decrease the amount of legal fishing grounds. This then has an influence on the fishing activity. You can also see how there’s closure zones which influence the legal fishing activity, and as well as these things, quota and total allowable catch. This influences the fishing activity. Now, the population of the cod fish influences the survey results, which then influences the amount of quota that’s given. There are also things such as gear restrictions, which also influence the legal fishing grounds. Here you have balancing loops and reinforcing loops.

 In this final stage of our system, we’ve introduced tipping points. In this case our tipping point is carrying capacity. This is the result of the reinforcing feedback which may occur when fishing activity gets so high that the population of cod fish takes a hit and decreases massively. This will then decrease so much that it will hit a threshold which will then change the carrying capacity. The reason for the lines and that it’s called a tipping point is because it’s often after a time delay.

 So now we’ve gone through an example of building a causal loop diagram, we can reflect on the building process. So, some positives of the causal loop diagrams is the ability to gain a deeper understanding of the system in question. This can allow for more informed choices to be made on your system, such as influencing policy changes or just knowing how a system may react under different circumstances. You can also involve stakeholders in the building process, which is quite a big positive because you can get a more varied perspective on how a system may react. Causal loop diagrams are also very useful for mixed and multi-method projects. This is because you can use qualitative or quantitative data to support connections.

 Some considerations that should be made when building the causal loop diagram is that they can get messy very, very quickly. This is why boundaries are needed quite early on to limit the size of your system because it can get big too quick. But this is where the iterative process of a causal loop diagram development is needed because you can perfect and practice and then you can know how to make a better causal loop diagram. Another thing to consider when building a causal loop diagram is that they can be subjective to the time and person that’s making it, but this is where engaging with stakeholders in the building process helps to limit the subjectivity. Also making the causal loop diagram is often more informative than the final diagram, but this is again where engaging with stakeholders can help because you could then potentially analyse the data of the interactions in the building process rather than the actual final systems diagram. Another thing to consider is that it can be quite hard to verify the significance of connections, and this is where data is needed or qualitative or quantitative.

 So, once you have your causal loop diagram, you can actually make some further advancements to your diagram, so this is to produce a systems dynamic model. To do this you would need systems modelling software and you can associate data and equations to your variables and connections to produce the model. The data that you can use can either be real data or assumptions. Once you’ve made your model, you can make behaviour over time graphs to see how a particular variable changes over time. This can allow simulations to be performed, where you can see how changes to the scenario impact the overall system for better or for worse.

 So, in this part of the tutorial we continued building our cod fish causal loop diagram. We then went through some considerations and positives that you should have when building a causal loop diagram, as well as some further advancements you can make to your causal loop diagram to make a systems dynamic model. So, now you’ve got all the tools that you need to start building your own causal loop diagram should you wish, and remember that it’s an iterative process. Enjoy building them.

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