

NGI101x - 1.4A - Problem demarcations part I

Warning: This video clip contains material intended for an audience of 18 years and older!

Hi! Now that I have your attention, let's talk about problem demarcation.

In this short video clip I will explain to you how you can demarcate your client's problem in such a way that the subsequent analysis of the system will deliver the most actionable information to your client.

It will be a rather abstract presentation, focusing on methods. If you are looking for a concrete example, then you should watch the second video clip on this same topic.

Let's first motivate why problem demarcation is important.

First and foremost, it is in your client's interest that you establish what is the problem that is most relevant to analyze.

Secondly, it helps you to be efficient: a good problem demarcation makes that you will look only into issues that matter, and that you do your analysis in adequate detail.

Thirdly, it helps you to be accountable for your findings. By demarcating the problem you make clear to your client what will be the scope of your analysis; in other words, the things that you will consider, and also the things that you might have considered, but decide to ignore. This allows both you and your client to reflect on how this will eventually limit the conclusions that you can draw, and the recommendations that you can make.

So how do you do problem demarcation?

In principle, you go through five steps:

You begin by choosing one issue that appears to be of immediate interest to your client. Something that your client wants to change or considers doing. From this starting point you perform a means-ends analysis. This will give you an overview of related issues.. You then develop alternative problem statements, and for each problem you make an objective tree and outline the associated system boundary. Comparing these alternatives will allow you to decide what problem should become the focus of your analysis.

To give just one example: if your client is the Port of Rotterdam, several issues might surface during your first talks: The port might, for example, want to deepen the harbor, increase the capacity of its container stacks, or reduce its CO₂-emissions. Each of these issues would be a good starting point for your means-ends-analysis.

By constructing a means-ends diagram, you obtain an overview of issues that you could focus on. The building block for this diagram is a means-ends box: a rectangle that you label with a single verb phrase that expresses something that your client wants to achieve (an

end). You use a verb phrase because a means-ends box also represents something your client can do (a means).

Starting from your first box, you develop your means-ends diagram by repeatedly asking two questions. You begin by asking “why?” to discover higher level ends that explain why your client wants to reduce CO₂-emissions. Then you start asking “how?” to identify for each end the means that could help your client achieve this end.

Let me quickly show you how these why and how questions lead to a means-ends diagram. By answering your “why” question for your starting point S, you get a higher level “means-ends box”. You draw an arrow to indicate that using means S will help achieve the higher level end H.

You then ask “why does my client want to achieve H?”, which will produce again a higher level means-ends. You repeat this until you reach your clients’ fundamental objective – let me label that with F.

You then start asking “How can my client achieve this?” for each means-ends you have discovered. This forces you to consider alternative ways in which your client may achieve its ends. There may be other means, in addition to H, by which your client can achieve F.

Likewise, there may be more ways, in addition to S, to achieve H, and possibly your client should focus on these. By continuing to ask “how?”, you may discover that your client has a wide range of means to achieve its ends.

At some point, you should stop, typically when the means become very detailed and operational.

By that time, the boxes and arrows that you have drawn form a means-ends diagram. The next step is to use this diagram to systematically develop alternative problem statements. In principle, you should consider each box in the diagram that has boxes connected to its bottom, because that indicates that your client has the means to achieve the end in this box. In my example, there would be six.

A good problem formulation expresses a dilemma or trade-off. In a means-ends diagram, however, every box is an end, that is, something desirable for your client. So we must now also look for bad things. The way to do this is to ask yourself “what are the undesirable side-effects of my client’s means?”

Let me show you how this works: First, you pick a box in your means-ends diagram and you take this (for now) to be your client’s focal objective. The diagram will then give you the means that your client may use to reach this objective. For each means, you then consider what side effects may occur when your client would use it. Means usually cost money, but you will often find other side effects as well: there may be safety issues, environmental issues, and so on.

The focal objective together with the undesirable side effects of the means to achieve this objective will produce a good problem formulation: “How can your client achieve one without causing too much of the other?”

You can do this for each box in your diagram, provided that it has boxes connected to its bottom. So if, instead of A, we focus on B, we see that our client has two means to achieve B. Both again have side effect X, and one also has side effect Z. This would then give as problem statement “How can our client achieve B without too much X or Z?”

We can do exactly the same for the other means to achieve A. Each time we look for undesirable side effects to identify the tradeoffs involved. So we imagine what would happen if our client decides to use means G and H to achieve C.

We do the same to find the tradeoffs involved to achieve D.

And let me give just one more example: when we consider G as focal objective, we imagine what would happen if our client would use means J, K or L, and if that leads us to identify also U and V as undesirable side effects, a fifth problem statement would be: “How can our client achieve G without too much U, X or V?”

What you do then is consider each of the problem statements you have formulated. Some may be more pertinent than others, and possibly you can already in this stage put some aside for being not (or not yet) the most relevant issue for you to analyze further.

For each of the remaining problem statements you then develop an objectives tree. This is fairly easy. Remember that the sole purpose of an objectives tree is to define crisp, measurable decision criteria for your client. A good objectives tree thus operationalizes the desirable and undesirable factors in the problem statement. In this example: A, X and Y.

Since an objectives tree needs a root, we add it: since the overall objective is to achieve A without X or Y, we can express this as “good A” – good, because it is A without any negative side effects.

We must then operationalize A, X and Y. If A cannot be measured directly, we must find proxies that can. Let’s assume that these are a1 and a2, and that for A to be good, a1 should be small, while a2 should be large. If X is monetary cost, then it can be measured immediately. And if Y needs further operationalization, this will – like A – involve finding good proxies.

By defining the criteria, we actually define part of the boundary of the system that we should consider when analyzing this problem: In our analysis, we should establish how strongly the means of our client will affect the criteria.

So our objectives tree provides the right-hand side of a system diagram. Likewise, the means-ends diagram provides the left-hand side.

If we do this for each of the alternative problem statements, we get an overview of alternative ways of demarcating our client's problem. This illustrates that, depending on how we demarcate the problem, we will focus our further analysis on different measures that our client may take, and on different outcomes of interest.

Okay. The purpose of this video clip was to explain how you can do problem demarcation in a systematic way. Starting from one salient issue, means-ends analysis reveals a broad range of problems that you could focus on. By doing a quick scan of each problem, you can then make an informed decision about what is most relevant for your client.

Remember: you do your analysis for your client. After all, it is all about your client's problem!