



## Value Chain Optimisation

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### Introduction

A key objective during front-end loading is to develop a project concept that is optimised to meet the business needs. All too often, projects are recycled at the end of a gate for “value engineering” because the required hurdle rate cannot be met. During the value engineering exercise, improvements are proposed, the savings banked and the project is approved to proceed to the next stage of the project cycle. These claimed savings often do not realise, because they were either ill-conceived, or they were/could not be implemented during the next stage of development. The result is that the project cost escalates again to the previous levels, or even higher.

The methodology followed during Value Chain Optimisation (VCO) is a rigorous and pro-active approach, across the full project value chain, during each development and design stage of a project. It ensures that only the required functionalities are incorporated into the project and that each proposal is fully tested and incorporated into the design before the project proceeds to the next stage.

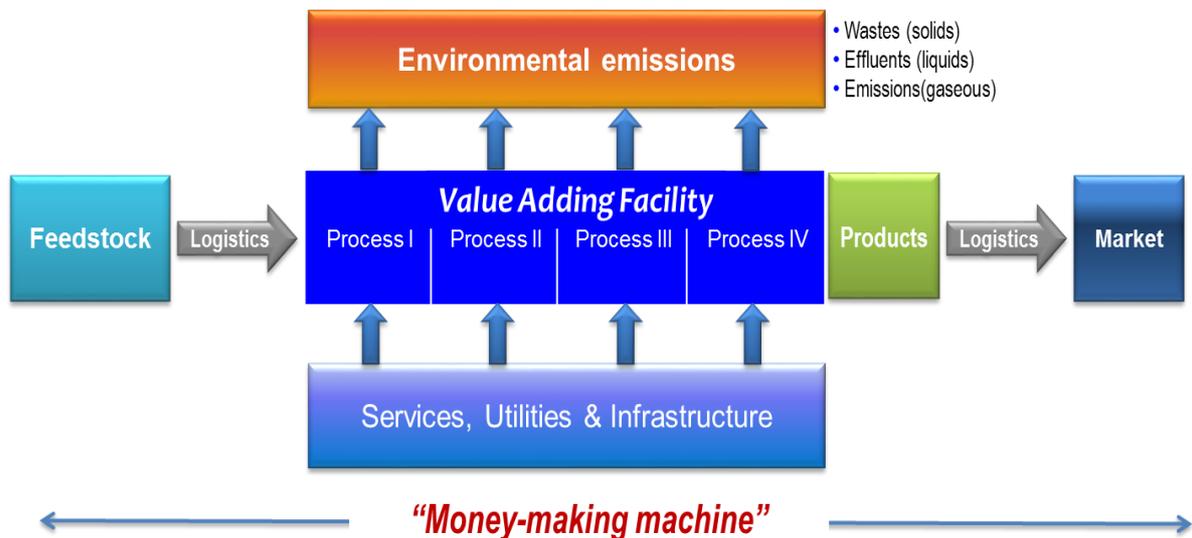
By following this methodology, improvements in NPV (nett present value), or IRR (internal rates of return), of typically 20 to 30% against the original project baseline are achieved on many projects.

### The project value chain

We firstly need to define exactly what is meant by the project value chain. A generic value chain is shown in Figure 1.

A value chain comprises all the steps in the process from obtaining the feedstock, processing this feedstock through the various steps up to final placement of the product in the market and delivery to the customer. Also included in the value chain are all services, utilities and infrastructure required, as well as any environmental protection steps to be taken.

Considering the full value chain, ensures all aspects are reviewed during the VCO process. It also ensures that any interrelationships, or cross impacts, are understood.



**Figure 1: The project value chain**

## The Value Chain Optimisation methodology

VCO is a rigorous methodology that is carried out throughout the project life-cycle in increasing detail. The VCO methodology entails the following steps:

- Identify “must” requirements and “nice to have” requirements
- Generate the minimum technical solution from “must requirements;
- Determine the cost and NPV for the minimum technical solution;
- For each “nice to have” option, calculate incremental capital and differential operating cost and NPV;
- Select only “nice to have” options that meet a predetermined hurdle rate; and
- Include these selected options in the optimised design; and
- Obtain sign-off on the optimised design.

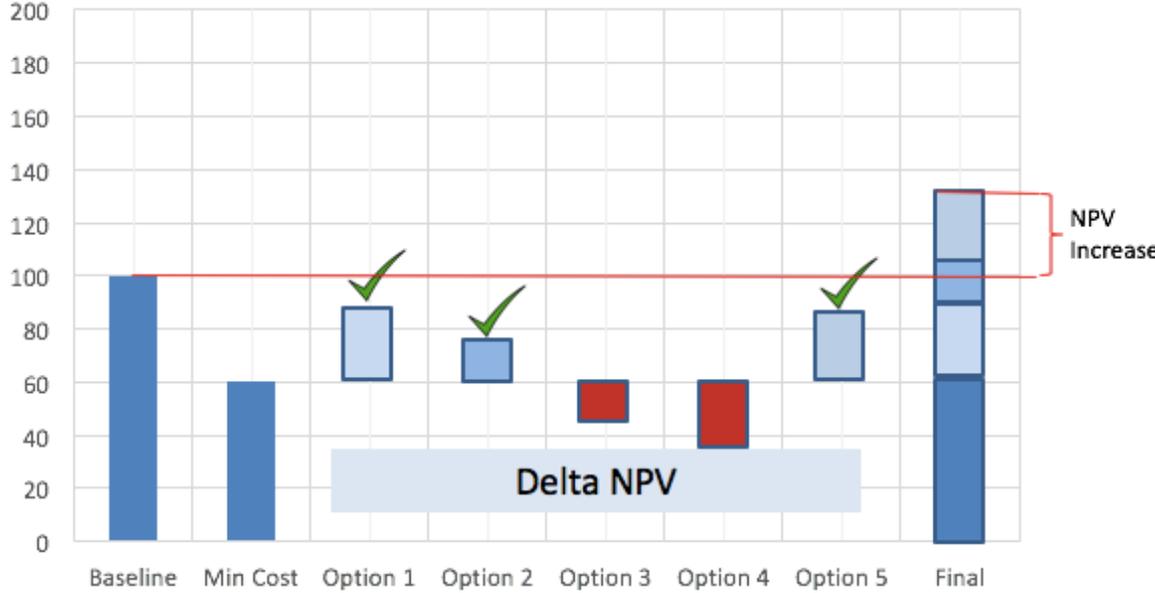
Specifications and requirements are categorised in musts, and nice to haves, and only the absolute must requirements are included into the minimum technical solution for the project minimum cost definition. This approach ensures that the absolute minimum capital cost solution that will meet the business need is defined.

For example, if water is required is required for the project and water storage is provided in the process design, the first question is if storage is a must or a nice to have. If it is a must, then it is included in the minimum cost, a nice to have is excluded. If, for argument sake, water storage is a must then the next question is whether a steel water tank is required or if a lined pond would suffice. During these discussions, the workshop leader needs to ensure that the absolute minimum capital cost solution is derived and not someone’s preferred solution.

Once the minimum cost and associated NPV for the minimum cost solution is defined, options (for each “nice to have” feature) are generated to improve from this point. For each option, the incremental capital and differential operating cost and NPV is calculated. Only options that meet a predetermined hurdle rate (e.g. positive NPV at cost of capital) is considered for inclusion in the optimised design. From these calculations, the graphs as shown in Figure 2 and Figure 3 are generated.



**Figure 2: Capital cost evaluation for each option**



**Figure 3: NPV evaluation for each option**

To obtain sign-off for the options to be included, the design is updated and verified to ensure that each solution is workable and safe.

Key to the success of this methodology is ensuring that the minimum cost solution is exactly that, and not some higher cost point that is the preconceived optimum solution as perceived by the team. Achieving the minimum technical solution requires an experienced facilitator that will keep on pushing the team until he/she is convinced that this point has been reached. There is normally a fair amount of resistance by the team as they typically perceive the minimum cost solution as an “unbearable” point and will not buy into it. This is understandable, but it must also be realised that the intent is not to actually build this minimum cost solution. The objective is to create an as-low-as-possible starting point from which to evaluate each and every improvement opportunity, as well as be able to justify its inclusion or not.

## Value Chain Optimisation levels of detail

The VCO methodology, described above, is repeated 4 times during the project life-cycle. Each repeat considers the next level of detail in a similar fashion as the prefeasibility stage is followed by the more detailed feasibility stage, and so forth. The guidelines for the different levels are described below:

### VCO Level 1

During the VCO Level 1 exercise, focus is on the feedstocks and products (quality, quantity, alternatives), production capacities, overall reliability, environmental as well as services, utilities and infrastructure inputs/interfaces, as examples. All streams entering and exiting the value chain are considered as well as the impact of these upon the design and cost of the facilities. This is illustrated by the red square around the production facility in Figure 4.

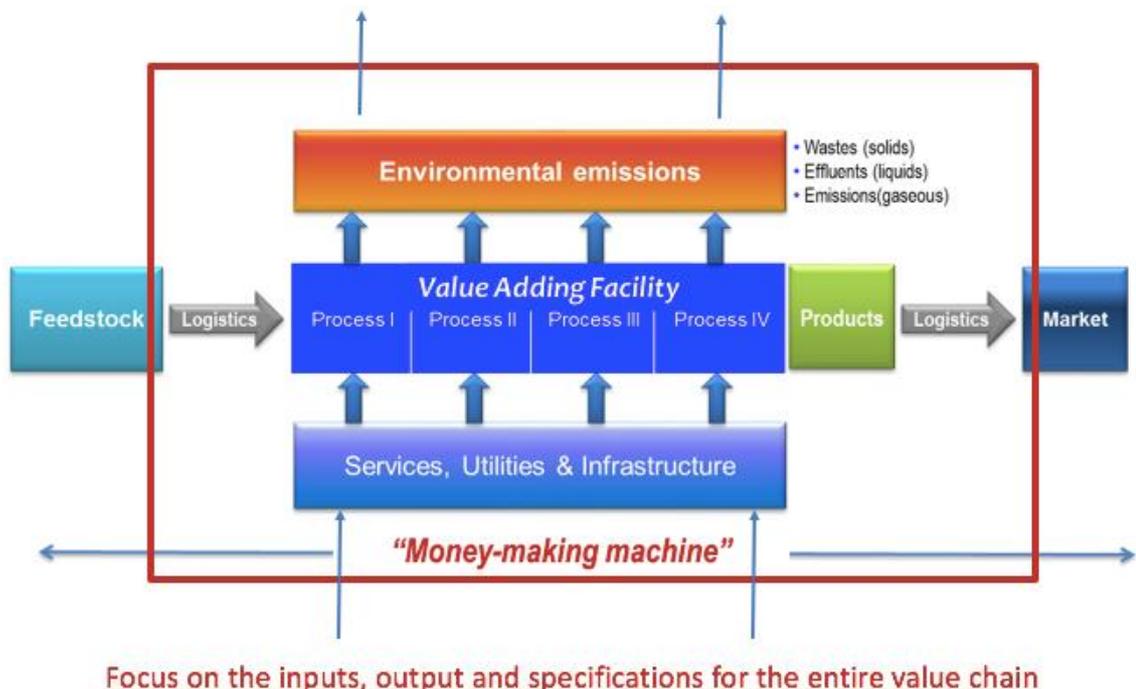


Figure 4: VCO Level 1

VCO Level 1 helps to cement the business plan and ensure that the overall requirements are optimised. The VCO Level 1 is often the point at which more than 50% of the improvements are realised.

The VCO Level 1 workshop is normally held at a point where the prefeasibility stage is around 50 to 75% completed. One would need, at a block flow level, a project concept, capital and operating costs, market data, revenues, as well as a working financial model.

### VCO Level 2

As soon as the facility can be subdivided into logical sub-areas, each with its costs, the VCO Level 2 exercise should be performed. This is normally during the early feasibility stage development. Each area is now individually analysed to determine the minimum cost and optimised solutions.

At this stage alternative technologies can be considered, as well as specification changes that could affect the overall sub-unit, buffer storages vs. reliability, layout alternatives, etc. One can clearly see that the amount of work to complete each level of analysis increases asymptotically and it is essential to ensure that the previous VCO level analysis has been done thoroughly, and has been duly signed off to prevent costly rework and time delays.

VCO Level 2 focus areas are illustrated in Figure 5 by the red squares around the individual process areas of the production facility.

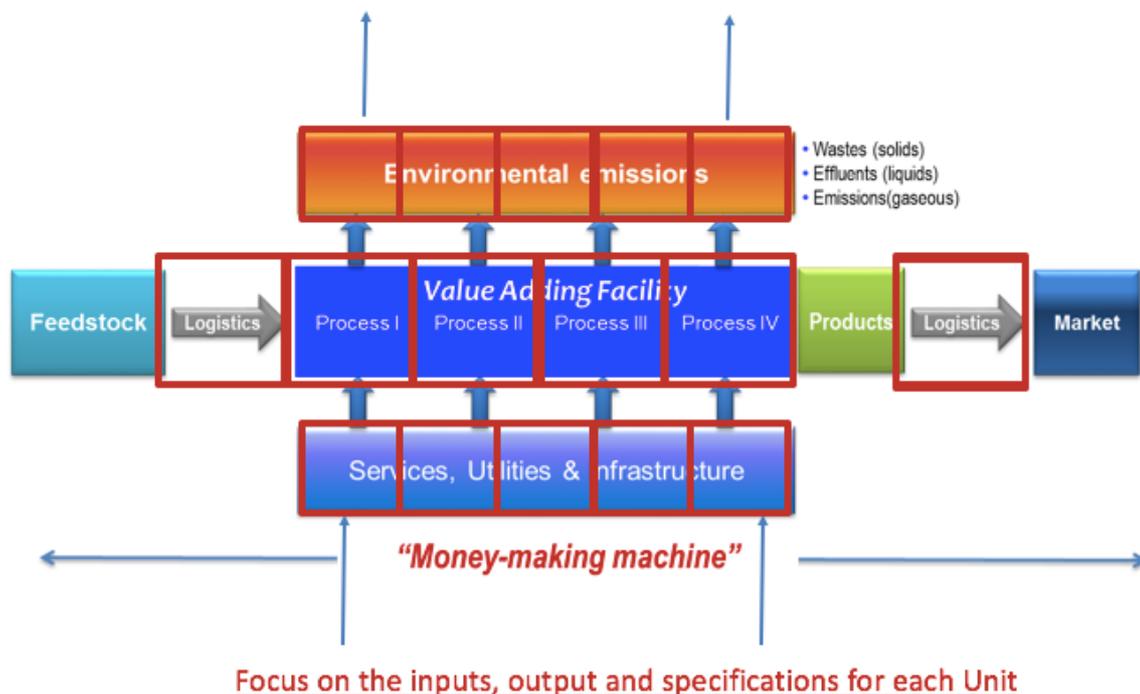


Figure 5: VCO Level 2

### **VCO Level 3**

During VCO Level 3, at least each major equipment piece is analysed to ensure optimum specification and selection. Types of compressors (reciprocating, screw, centrifugal), designs of pressure vessels (pressure, temperature, material of construction, no. of nozzles, etc.) is analysed. This exercise is normally carried out toward the end of front-end engineering and design, or early in detailed engineering.

### **VCO Level 4**

The objective for VCO Level 4 is to decide on the optimum procurement practices. Different suppliers for the equipment are considered, procurement strategies are developed, spares holding requirements and maintenance practices are reviewed. This exercise is carried out at the start of the procurement cycle.

## **Some practicalities**

### **VCO Reviews**

Before finalising the work for a specific level, it is required to review the specifications and conclusions of the higher-level work to ensure no changes will contravene the boundaries set at the previous level. If required, some modifications must be made to ensure the overall design is still sound and the changes have been fully evaluated and incorporated.

### **VCO workshop attendance**

The VCO workshops should be attended by the project and business teams responsible for the development, as well as external subject matter experts that can provide alternative views. Normally VCO Level 1, Level 2, and, to a certain extent, Level 3 (depending on the practicality) are facilitated by VCO experts.

During the VCO Level 1 and Level 2 sessions, the project teams are trained to apply the VCO principles within their work groups. From VCO Level 3 workshops onward, the workshops are run by the teams themselves, utilising external experts as required.

## **Closing remarks**

Value chain optimisation is a very rigorous process that has been proven to improve the business value of a project across the complete value chain by a large margin. It is advised to use experienced facilitators to introduce the concept and to train the teams to be able to carry out the more detailed exercises themselves. Attention to detail and a dedicated team with the necessary management support is essential to ensure success.

Contact OTC for more information, and assistance, to improve the likelihood of project success.