HOW TO JUSTIFY THE COST OF QUALITY
COMMODIFICATION AND THE CAPEX TRAP

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Abstract

This paper introduces the terms “commodification” and the “CAPEX trap” within the context of turnkey packages for the Oil &Gas industry. The underlying reasons for the commodification of high-specification projects in the Oil & Gas industry are discussed, focusing especially on common quality problems, and their possible effects on project budgets.

It is shown how seemingly near-repeat packages are often subject to commodification by the seller before contract, which often causes an inevitable CAPEX trap for the buyer after contract signing. A link between indirect consumer costs and poor quality is shown to be an often overlooked or undervalued factor in the total project equation.

The paper concludes that a high-level of indirect costs can quickly make commodification, outsourcing, or standardization strategies poor choices for projects with stringent quality requirements. Typical warning signs and alignment exercises are presented through the use of SMART methodology, as tools to help projects avoid the CAPEX trap.

Definitions and introduction

Commodification

The Collins English Dictionary describes commodification as the *“treatment of something as a commodity”*; usually referred to in the context of something being treated as a commodity that has not traditionally been considered as such. In this paper we use the term more specifically in relation to the manufacturing of products, as follows:

> *Commodification is the standardisation/simplification of requirements, so as to assume that an engineering package can be considered appropriate for multiple clients/projects before investigating the details.*

Commodification is often a good choice, and many products, for instance coffee mugs or online data backup services, are indeed highly suitable for commodification, even though it is possible to find cases where customers differentiate between even these products because of personal or technical requirements. For the coffee mug, it could be the quality of the porcelain or the shape of the handle; while for the data backup service, it could be the location of the physical servers or the encryption methodologies applied. However, such customer preferences will not in most cases result in any major product quality mismatch. Most of us are happy to use a coffee mug, even if the handle is not exactly the right size. It is important to understand that for high-specification products however, an almost correctly sized product is normally an unusable product. One can assume, therefore, that the more “everyday” the product is, the more acceptable it has become that the product has been commodified. This perspective seems also to be that of manufacturers, where the attraction of potential upsides and the urge to commodify is so strong that it is uncritically applied to more and more products. This trend has the potential to lead both themselves and their customers down a path ending in a product with the wrong quality. Commodification is, in its basic element, based on the assumption of fungibility for products intended for particular clients and markets. However,

> *The assumption of a fungible product quickly becomes false when the amount of engineering needed for the product requirements increases.*

Quality

Most definitions of quality involve conforming to the expectations relating to specifications, performance, timely delivery, reliability and cost. The exact parameters and how they are defined, will depend on factors such as the product's role in the marketplace, its purpose or service, and upon the agreed defect tolerances.

In this paper, quality is considered from the perspective of those manufacturers and customers dealing with high-specification products and services within the oil and gas industry. It is important to note that a different view of quality exists between the two parties. While the manufacturer is concerned about quality from a bigger market perspective, customers are more concerned about the specifics of the project at hand. To illustrate this, we have included a selection of different industry views regarding quality, as shown below:

Figure 1: Manufacturer/Customer focus regarding on quality

Manufacturer	Customer
Conformance to industry standards	Conformance to project specifications
Benchmark performance	Process performance
Reliability from warranty perspective	Reliability from serviceability/design life perspective
Consistency/Standardization	Fit for project
Cost margin	Value for price (Return On Investment?)

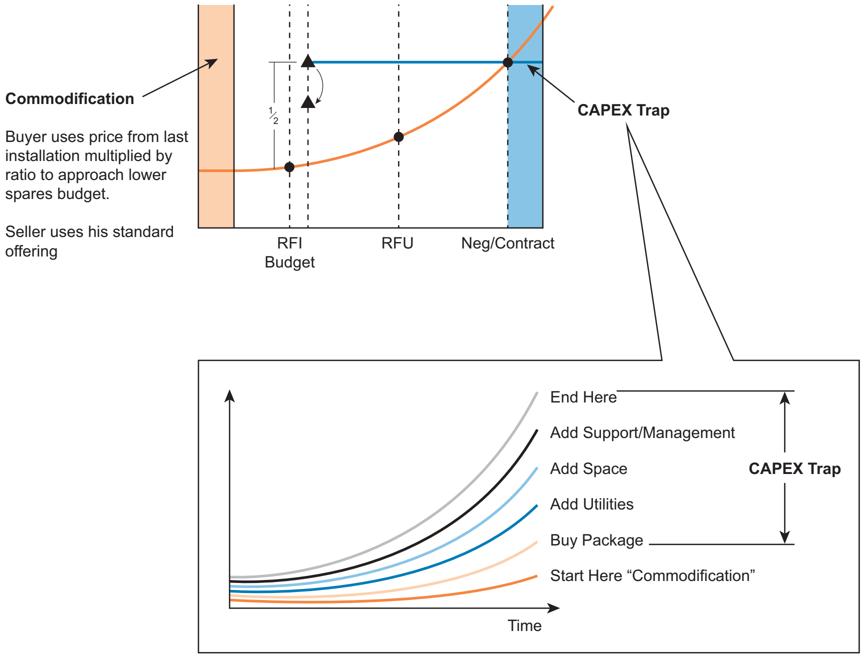
As seen from table 1, the manufacturer's approach to quality definitions is inherently different than that of the customer, and so is the cost of quality. It is often overlooked, but the cost of inadequate quality is much higher for the customer than for the manufacturer. More than fifty years have passed since Joseph M. Juran began advocating the link between quality and cost. Influenced by American and Japanese culture in the middle of the twentieth century, leaders in quality theory at the time focused on quality purely from a manufacturing perspective. External or indirect costs are typically considered, from a financial point of view, as being "costs incurred from a decision made by others, on which we have little or no control."

This paper recognizes the work of quality management thinkers, theorists and consultants, while it expands cost of quality considerations to also include external or indirect quality costs from the customer's perspective.

CAPEX Trap

Previous papers on the cost of quality have normally dealt with the costs involved for manufacturers to provide a product without proper quality management. They have, to some extent, covered the cost of discovering the non-compliance of products with requirements after installation at the customer's site, but in most cases the assumption is made that the cost of changing the product, or in other ways correcting the defect, falls upon the supplier. The additional indirect or external costs incurred from the customer's perspective are often not considered. In the Oil & Gas industry, the cost to the client resulting from a product supplied with a different quality than what is expected, can become a significant factor having a major impact on an entire project.

Figure 2:
CAPEX trap



Why commodification clashes with high quality projects

Commodification can lead a project into the Capex trap because of two common (and erroneous) beliefs.

1. That any product can be referred to as a standard product as long as all the components have previously been engineered, even though not in the same order, not from the same factory, or for the same process.

2. That custom engineering is not required, as long as there are sufficient testing or procedures in place to verify the correctness of the product before delivery.

Both are examples of where the commercial benefits seen from commodification have led manufacturers into trying to make a "one size fits all" product. In other words, they have tried to commodify the product. Our argument, as seen from the CAPEX Trap, is that where quality is of importance, most products should not be commodified.

Philip Crosby, a respected quality manager and the author of "Quality is Free", proved how "low, medium or high quality" are in reality meaningless concepts, because quality is about conformance to a set of requirements.

Either the requirements have been conformed to, or they have not.

A manufacturer can, in other words, create a product with certain specifications, or of a certain quality, but for a customer with different quality requirements, the product will not be a good fit. More commonly, a customer with expectations of quality outside industry accepted standards, will have a reason for requesting the more stringent requirements, and the supplying of a “standard” product can result in the customer not being able to implement it at all.

Crosby introduced the concept of “zero defects”, which raises the bar of quality acceptance. This is achieved by changing the outset of any engineering project through removing any “allowances” or “substandard targets” being introduced as a mechanism to make the project more acceptable for commodified products, or for lowering the expectations for the final project results lower because of assumptions that there will be, some deviations from the quality requirements, even before embarking on the product engineering.

Crosby’s concept of how “measurement of quality is the price of non-conformance” has been a major contribution to management thinking, and is more relevant than ever when it comes to high specification packages with custom engineering.

Crosby shows how organizations lose 1/3 of the project revenue by having to re-do work due to non-conformance, and this portion is arguably exponentially higher for high-cost, high-engineering packages.

The cost of quality - manufacturer quality versus external costs

There is a clear link between quality management during fabrication and end-user operational costs. An evaluation of both the manufacturing and customer costs provides a dimension to the cost of quality that should be especially interesting for those producing and procuring products in high-quality environments.

The CAPEX trap is an unfortunate example as to how, by treating a turnkey product as a commodity, budget overruns are almost guaranteed. When project costs are over emphasized, and quality and the matching of the product with customer requirements are under emphasized, too little, we quickly end up in the CAPEX trap. The product’s indirect costs, after delivery to the customer, can grow un-proportionally, and a product that on paper seems to be 95% right, has the potential of exponentially escalating the total project costs.

Considering the total cost of changing the product after delivery, updating the project documentation, waiting for new parts, and other indirect or external costs related to a quality defect, we see how any deviation from the client’s package specifications in order to be able to supply a “vendor standard“ item, is a dangerous exercise that can cause OPEX costs to soar.

Figure 3:
Quality is right (manufacturer)

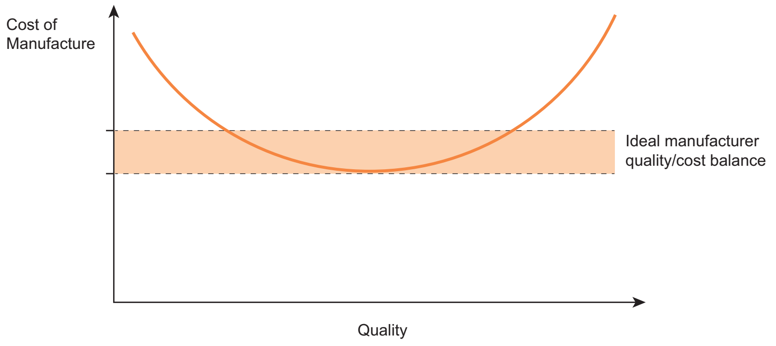
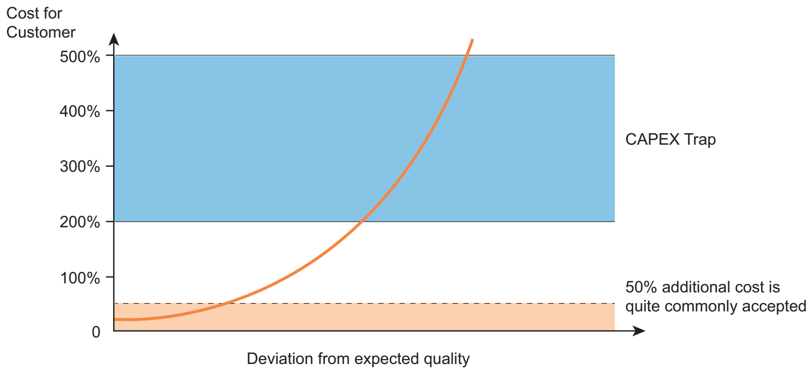


Figure 4:
Quality correction is expensive (customer)



How to avoid the CAPEX trap

Warning signs/detecting the trap

Both manufacturers and customers must remember that the quality should be right for each individual project. It is important to be aware that misplaced commodification can inherently lead to the CAPEX trap. Furthermore, it is important not to neglect the potential penalties resulting from ending up in the Capex trap. The false assumption from the buyer or seller that CAPEX equals the actual expenditure, while not considering the lifetime OPEX or utilities/maintenance/space/weight cost impacts, should be a warning sign.

Manufacturers that have applied outsourcing/commodification/standardization practices also have a tendency to underprice a package solution because they do not have the 'big picture' perspective, or cannot understand the entire scope required to meet a different quality level.

On the other hand, customers have a tendency to simplify a package, not taking into consideration the cost of interfaces/boundaries to a package, and to use the cost of the product for previous projects as a base for budgetary estimates for new projects.

For turnkey solutions that involve engineering, most package requirements change only slightly over time making each project seemingly similar to the previous one. Near-repeat packages are often subject to false commodification by the seller before contract. For the customer, it can seem that the supplier has investigated and understood the requirements, or that their quality management systems and good statistical defect record are sufficient to reduce the risk of product defects. In these situations it is difficult to realize the danger of the CAPEX trap.

Some clear tell-tale signs exist that should alert buyers of a lurking CAPEX trap. The most obvious example is a supplier that provides a budgetary quotation, and then increases the cost of the product before the contract signing without any major requirement changes from the customer. It should at this stage be obvious that quality expectations and product requirements are not aligned between the customer and the manufacturer.

Most consumers and manufacturers agree that statements like “you get what you pay for”, to some degree are true. Edwards Deming, arguably the world’s most successful industrial quality management theorist, stated that; “Quality is not the preserve of the few, but the responsibility of all” (Deming, 1982). Deming became famous for his fourteen points, one of which reads; “End the practice of awarding business on the basis of price tag alone. Instead, minimize total cost by working with a single supplier”. Although tempting to always reduce costs, it might in fact be a better idea to focus instead on other aspects, such as strengthening the capability of a supplier to understand customer requirements; enabling the client to undertake new projects for this customer, even if they have had to move their product lines to a different location, or if their quality system for some reason is not optimized at some point in the future.

Aligning the expectations between customer and manufacturer can prove to be the best cost-saving exercise for most high-quality projects.

Aligning the expectations

“The definition of quality depends on who defines it”. Or in other words; the “wrong quality” is sometimes no better than “poor quality”. Bluntly stated, it matters less how many quality system engineers, certificates, or impressive statistics we can show; unless we also understand that the design of product quality must first and foremost match the required quality from our client. When the quality is not the right quality, customers end up paying a large price tag in indirect or external costs. A manufacturer sometimes knows better than the client what the best quality of, for example, an offshore pipe is, but the customer can see the big picture, and his evaluation of the required quality is often more correct. We need to consider both sides, and align the quality expectations for each product.

Aligning quality expectations with supply is not necessarily an easy exercise, but a few steps can be used as a guideline. Our experience is that most mistakes in relation to quality alignment are the result of an unbalanced or incorrect view of one of the following four topics:

Figure 5:
Topics of Consideration for Quality Alignment

Topic	Description	Influence of commodification
Criticality of Requirements	How important are the defined customer requirements for the project?	Customers will have less differentiated products to choose from, and in order to find a product that will fit, requirements tend to follow the products that are available, rather than what the customer ideally requires. With the realization that selection of possible manufacturers decrease specific requirements increase, customers are often tempted to deviate from engineering specifications and request standard products instead.
Understanding of Requirements	How well have the requirements been documented, and how well has the manufacturer understood the requirements?	Manufacturers follow international standards in order to make products with maximum market potential. It is common for manufacturers to believe that their product will meet all customer requirements because of their international standard compliance. Often it becomes a case of customers expecting that the manufacturer has read the specification, while manufacturers expect the customer requirements to be aligned with international standards. The mismatch is often not discovered before verification of the final product specifications/quality.
Established Quality	What is the level of existing quality awareness, experience, and the quality system of the manufacturer?	The commodification of products has contributed to more standardization and a higher focus on established quality systems. Many manufacturers realize that quality systems reduce the cost of the total product, and methodologies such as lean, six sigma and TQM have increased in popularity during recent years.
Adoption of Quality	Does the manufacturer have the ability and willingness to undertake new quality requirements?	Standardization of products has decreased manufacturers' ability to produce custom products. Flexibility in manufacturing will often not fit with quality systems, and a small change from the standard product, if at all possible, will often add exponential cost and risk to the product.

By evaluating the above points and reaching a score for both “experience” and “capability”, we can apply a simple formula to determine the quality alignment:

Quality Alignment = Experience / Capability

Expectations (Exp)		Criticality of requirements for customer			
		Extreme	High	Average	Low
Supplier understanding of customer requirements	Extreme	2.6	1.7	0.8	0.5
	High	3.7	2.8	1.6	0.9
	Average	5.2	4.0	3.0	1.7
	Low	6.5	5.2	4.5	2.6

Figure 6:
Quality expectation matrix

Supplier Capability (Cap)		Supplier existing quality awareness, experience and/or quality systems			
		Extreme	High	Average	Low
Supplier ability and willingness to accept dynamic quality requirements	Extreme	6.5	5.3	3.4	1.6
	High	5.2	3.9	2.5	1.1
	Average	2.5	1.8	1.1	0.7
	Low	1.5	1.0	0.6	0.2

Figure 7:
Supplier capability matrix

Figure 8:
Quality alignment score evaluation

(Exp / Cap)	Description
> 2.5	• Watch out for the “Capex trap”. • Very rarely will projects end here, but if they do; it can have severe consequences. • Major cost escalations will mainly impact the Customer in the range of project cost + 300% and upwards.
1.7 — 2.5	• A seemingly low-cost, high-quality product for one customer can for another customer end up either being high-cost or low-quality due to slightly different customer expectations. • A mismatch between expectations and quality is most difficult to discover here; and the result will potentially cause significant project/maintenance cost escalations for the end-user, and/or significant quality modifications/rejection costs for the supplier. • Escalation in the range of project cost + 100-300%, with the majority of the cost covered by the Customer, since challenges typically will be outside the scope of supplier warranty/guarantees. • This is a common result of selecting suppliers with poor quality management.
1.2 — 1.7	• The ideal situation for Suppliers, and where market forces are driving products. • Most projects are located here. • Industry has become more or less resigned to a cost overruns within a range of 0-30%, where most are covered by the end-user, or as part of the supplier’s warranty/guarantees.
0.8 — 1.2	• Although not normally the first choice, this is proven to be the ideal situation for the customer. • Cost and delivery times will normally be met based on budgetary/contract assumptions. • The customer will typically save 30-50% of maintenance/service costs throughout the lifetime of the equipment, due to the “most efficient quality level.” • For larger (5MUSD ->) projects, this is also an ideal long-term situation (because of risk considerations) for the supplier.
> 0.8	• Should be identified early as a possible cost mismatch. • Very rarely will a project end here, because suppliers will typically fail to meet customers’ commercial expectations in the project budgetary phases. • Successful projects in this range are most typically where the supplier acts as a consultant or offers early-stage/prototype products.

For example, a customer with an “average” understanding of the requirements in a project where the customer criticality of the requirements being overheld is “high” will give an Exp score of 4.0. If, at the same time, the supplier has a “high” willingness to adapt quality to suit the actual project, combined with an “average” existing quality system, this will give a Cap score of 2.5

The Exp/Cap formula gives an alignment score of 4.0/2.5 = 1.6, which is a typical score for most projects. This could lead to further investigations, for example, into the actual state of the existing quality system, which might prove to be very important for the project result.

Preparation

With an understanding of the dangers of commodification and the capex trap, it seems easier for the manufacturer to make the required changes in order to better align expectations. However, it is the customer that possesses the market power and has the ability to influence the direction of quality. Without direction from the customer, manufacturers will not have the required incentive to break the desire for commodification.

SMART methodology, shown below, is a recommended approach for customers to improve the alignment score (bring it closer to 1) for turnkey high-specification projects. The SMART methodology is based on our experiences in this market over the last decade, and has proven to be an effective “best practice methodology”, both for our own and our customers businesses during the budgetary and early-engineering phases.

Figure 9:
SMART Methodology

S — ***Solution:*** *stay true to the selected solution. Any unjustified change will give any supplier / vendor a chance of adding cost to either cover their own mistakes or to increase the margin. The supplier / vendor can walk away from the project pre-contract. You can’t.*

M — ***Manage:*** *manage and run the project correctly from day one. Avoid timely and risk –increasing project changes. Stay true to your project management philosophy.*

A — ***Architecture:*** *ensure that all the bits and pieces are a part of the big picture – more and more smart electronics and safety systems calls for more and more cabling and layers of control and safety. Have the big picture ready from day one.*

R — ***Review:*** *properly review all data received, including pricing. All too often the prices given come with a huge list of reservations. If it looks too cheap it often is.*

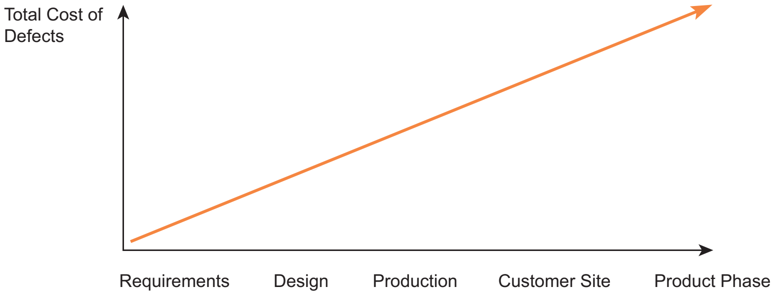
T — ***Technology:*** *align the technology currently used and ensure that any new technology / product changes can be accommodated later without major impacts (non-refundable).*

Conclusion

We have argued how the ability to have a dynamic approach to quality closely aligned to end-user expectations is more important than routine quality management, and studies of empirical quality statistics. Practical experience from decades of supplying quality critical products has shown how simple measures, such as shorter routes between end-users, salespeople, engineers and fabricators, can create higher quality awareness and in turn lower the total cost of projects, and how this approach from a "total equation" perspective brings more value to projects than commodification.

Definitions of Quality, such as the one from the Total Quality Management (TQM) approach, always recognize the fact that detecting and correcting product defects are lower during the early stages of product development, and larger during the later stages (Operations Management: An Integrated Approach, 2012).

Figure 10:
Total cost of defects



Our argument is that the curve is exponential, with the pivot point at the production phase. As pointed out earlier, after delivery to the customer's site, a range of indirect costs is also involved. If the difference between discovering a defect during a requirement phase and a design phase is considered 1:2, and discovering a defect in the design phase rather than the production phase is considered as 2:8, the difference between discovering a defect during the production phase rather than at the customer's premises can be considered as high as 8:64, or even 8:256, 8:1024 - or higher if the product is already in operation and is considered a critical element. One example can be a significant part of an FPSO (Floating Production, Storage and Offloading) vessel failing, which means halting oil extraction until the defect is corrected.

The definition of commodification from the introduction can be rewritten as:

> *"Commodification is the standardization/simplification of requirements, so as to prematurely assume that an engineering package can, from a commercial point of view, be considered appropriate for multiple clients/projects before fully investigating the details".*

Figure 11:
A Wärtsilä Moss inert gas generator system installed onboard the 'Goliat FPSO'

Want to know more?

Please contact us:

moss-offshore@wartsila.com