The Essentials of Preparing Cost Estimates
Yielding Long-run Profitability

By

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Executive Summary

This research is based on the study of all the various steps and elements involved in estimating costs of projects. The different factors, whether it be human resources employed, concepts applied or processes used, affect the outcome of a price estimate and hence, the profitability of a project in the long run. The effects of all these aspects on the accuracy of estimating the cost of a proposal are analyzed in detail. The five basic elements having the greatest effect on a cost estimate are communication, processes, accuracy of the resource planning system, work instructions and company-wide practices. Several recommendations are listed on how to improve these five basic elements at FMC Technologies to produce cost estimates yielding long-run profitability.
Chapter 1 – Introduction

Across all contract manufacturing and consulting industries, a critical factor in the rise and fall of corporations is the strength or weakness of their bidding practices. Since FMC Technologies is a contract manufacturing firm, proposal or tender preparation is considered a pivotal element of the business model. Bids are the gateway to new business and revenue thereafter. An entire department is dedicated to quotations, along with cost estimators embedded in each product group. Hence, this research is entirely dedicated to the process of preparation of cost estimates at FMC.

The ultimate success of a project is determined by its profit contribution. The first step in maximizing the profit contribution of a project is the accuracy of costing. Therefore the end results depend on the accuracy of the cost and resource estimating, done at the bidding stage of a project. Any mistakes made during the process of estimating the cost of a project can mean either losing the business to competitors, or winning the business at lower than market price. Booking projects at a lower rate than the market is detrimental to profit in the “long run”, meaning profit loss is incremental through the entire run of a project. A short run success, on the other hand, would be winning the contract award without considering any margin erosion throughout project execution. A project is considered profitable in the long run if the margin stays above an acceptable level through the entire execution of the project. At project close out, the margin is not only positive but meets or exceeds the target set by management.
Good estimates lead to projects that see very little or no margin decline from the
time they are priced and quoted to the customer, to the time they are completed. The
margin at project close out is a good gauge of how well the scope of the project was
captured at the initial bidding stage, and how accurately all contingencies were
appraised.

Details of bidding strategy are discussed in later chapters of this research. This
research also gives the details of what various departments within an organization
find important in the preparation of a bid. Finally, current practices and local work
instructions at FMC are analyzed in order to determine the strengths and weaknesses
of bidding practices at FMC. The research ends with recommendations that should
help streamline and optimize cost estimating practices at FMC.
Chapter 2 – Literature Review

The literature review spans a diverse spectrum of articles related to estimates and proposals. There was a plethora of information about the different stages of proposal development and cost estimation. All of the collected information is summarized in this chapter.

Understanding the Science of “Cost Engineering”

An important dimension of engineering that is based on assessing and controlling the cost of a product throughout its life cycle is cost engineering. This is accomplished through “Total Cost Management”. It is this area of engineering practice where engineering judgment and experience are used in cost estimating. Design engineers should be trained to focus on the important dimensions of money, time, and other resources that are invested in the creation of the assets they design. There is an intimate connection between the physical and cost dimensions of these assets. Cost engineering practitioners or estimators do not necessarily have a technical background, but need to share a common understanding, based on scientific principles and engineering techniques.(Hollman 2007)

Definition of an Estimate

Accumulation of elements and the calculation of all the costs associated with those elements, is estimating. Anything and everything that would influence the cost of a project needs to be considered.(Schamel 2003)
An estimate is, basically, a rough calculation of the probable cost of a project, but most people look at estimates as absolute numbers. (Lukas 2006) Therefore, the accuracy of estimates is quite elemental for a company to price projects appropriately. Given that fact, it is important to know the barriers to accuracy of estimates so steps can be taken to avoid them. Those barriers can be any or all of the following: (Lukas 2006)

1. **Lack of Scope Definition** – It is difficult to estimate what is not known.

    Figure 1 (Lukas 2006) shows that the path to good estimates is first developing the project scope. The project manager is responsible for working with the client to ensure their requirements are documented. From good documentation the project team can determine the major deliverables needed to meet requirements.

2. **Poor Communication** - Good communication between the project team and the estimating team is essential to provide the information needed to prepare quality estimates.

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**Figure 1**

The path to good estimates and schedules is first developing the project scope
3. **Unrealistic Client Expectations** - An estimator should always give a range of numbers, starting with the higher number rather than the lower number, and not allow the project team to pin him/her down to a specific figure early in the process. Figure 2 (Lukas 2006) shows the relationship between the amount of project definition and the accuracy of the estimate. Typically, even for projects with relatively simple scope, at least 20% of the scope needs to be well defined to allow the estimator to prepare a preliminary estimate.

![Figure 2](image)

Estimate accuracy is dependent on the amount of project definition

4. **(Overly) Optimistic Team Members** - The final barrier to accurate estimate preparation are project team members that tend to be overly optimistic in estimating how much time is needed to complete their project activities.
Key Functions and Elements of Good Estimates

The key function of good estimates is to acquire new business at the right price, and hence providing a gateway to long-term survival in business. (Ahcom et al. 2006) The success of projects largely depends on the accuracy of the estimate. The issues in accurately estimating the cost of a proposal are summarized in the following key points: (Lukas 2006)

1. Never estimate alone. Multiple reviews and opinions are better.
2. Appropriate amount of contingency should be added. Even a detailed estimate is a range of outcomes, not an absolute number.
3. Estimates should not be exact numbers, but a range of possible costs.
4. All assumptions and exclusions should be documented.
5. All direct and in-direct costs per project scope should be included.
6. An effective cost estimator should have either direct knowledge of material and labor costs or a good relationship with the appropriate people who can provide this information.
7. Estimating cost is directly related to the cost of quality, so involvement of the Quality department is also important.
8. Use good estimation software. Estimating software adds value to the cost estimate. The results of an experiment in software costing showed the use of software was somewhat beneficial. However, the benefit of software was productivity, not accuracy. (Betteridge 1992)
Categories of Estimates

In order to determine the best approach to estimating the cost of a project, it is important to have knowledge of the various categories of estimates. The categories of estimates are: (Lukas 2006)

1. **Order of Magnitude**- These estimates have minimal accuracy, since they are prepared with limited information. Such estimates are often used for strategic business plans.

2. **Conceptual Estimates**- These are only 50% accurate since these are pre-study estimates.

3. **Budgetary**- These estimates are 70% accurate and are often prepared to support project funding request. These are very common in the Oil & Gas industry. Estimates prepared by this method are made by first estimating the delivered "bare" equipment cost and then applying factors to each item to develop the additional labor and materials required to install each item. (Uppal 1997)

4. **Detailed or Defined Estimates**- These are 85% accurate because they are prepared when most of the project definition is known. (Lukas 2006)

5. **Control or Check Estimates**- These estimates are usually prepared when project is completely defined.
Figure 3 (Lukas 2006) describes the typical definitions and accuracy ranges used to describe various types of estimates.

<table>
<thead>
<tr>
<th>Estimate Class</th>
<th>Estimate Name</th>
<th>Typical Accuracy</th>
<th>Definition Needed for Low Tech Projects</th>
<th>Definition Needed for High Tech Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 5</td>
<td>Order of Magnitude</td>
<td>± 100%</td>
<td>2-5 %</td>
<td>5-10%</td>
</tr>
<tr>
<td>Class 4</td>
<td>Conceptual</td>
<td>± 50%</td>
<td>5-20%</td>
<td>10-35%</td>
</tr>
<tr>
<td>Class 3</td>
<td>Budget or Preliminary</td>
<td>± 30%</td>
<td>20-40%</td>
<td>35-60%</td>
</tr>
<tr>
<td>Class 2</td>
<td>Detailed or Definitive</td>
<td>± 15%</td>
<td>40-80%</td>
<td>60%-90%</td>
</tr>
<tr>
<td>Class 1</td>
<td>Control or Check</td>
<td>± 5%</td>
<td>80-100%</td>
<td>90-100%</td>
</tr>
</tbody>
</table>

Figure 3
Typical definitions and accuracy ranges used to describe various types of estimates

Cost Estimating Methods

Having established the various classes of estimates, it is imperative to know the various methods available to estimate costs appropriately. The five primary cost estimating methods are:(Garrett 2008)

1. **Analogy Method**: This approach is based on using historical data from similar projects in the past. The advantages of using this method are that it can be used early in project definition, it is defensible due to availability of historic data, and these estimates can be developed at minimal cost. Disadvantages of this method are that analogy depends on a single data point, sometimes detailed data for analogy is not available, and technical adjustment parameters might be skewed.
2. **Parametric Analysis Method:** This method is based on deriving the cost of the significant components from similar other components based on weight, dimensions, quantity or duration. This often involves normalizing costs to unit costs. For example cost of new valve blocks or structural steel parts can be assessed based on $/lb (total cost divided by the weight of the part), derived from recently purchased parts of similar geometry. On a larger scale, this type of costing may require regression analysis using the relationship between the cost of an item and the various cost drivers to produce a linear or non-linear fit.

3. **Weighted Average Method:** This method is similar to the analogy method but uses more than one data point from history. The advantage of this method is that it is simple and low cost; however, it is only as accurate as the historic data used.

4. **Technical Census Method:** This method is used if no historical data is available. It requires a pool of experienced knowledge to build a cost estimate based on assumptions and median responses of the group.

5. **Engineering Build-up Method:** This is a bottom up approach which starts with Work Breakdown Structures (WBS) and includes all overhead and fees added to material cost and labor hours.

**Essentials of Winning Cost Estimates**

Cost estimating is an inexact practice, a blend of art and science and, therefore, full of risk. (Garrett 2008) Yet an estimate is a pivotal element of a proposal. Hence, it is most important to identify and minimize the risks associated with estimating the cost of a
project, and choosing the right pricing strategy is critical to ensure the long run profitability of a project.

1. *Minimizing risk and maximizing accuracy:*

The Government Accountability Office (GAO) has studied the basic characteristics of effective cost estimating for 40 years. They have developed a list of nine basic characteristics that have proven over time to affect the accuracy and reliability of cost estimates. See Figure 4 (Garrett 2008) on the following page, for details.
## GAO's Basic Characteristics of Credible Cost Estimates

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
</table>
| Clear Identification of Task            | • Estimator must be provided with the system description, ground rules and assumptions, and technical and performance characteristics.  
                                          | • The estimate's constraints and conditions must be clearly identified to ensure the preparation of a well-documented estimate. |
| Broad Participation in Preparing Estimates | • All players should be involved in deciding mission needs and requirements and in defining parameters and other system characteristics.  
                                          | • Data should be independently verified for accuracy, completeness, and reliability.                                                      |
| Availability of Valid Data              | • Numerous sources of suitable, relevant, and available data should be used.  
                                          | • Relevant historical data should be used from similar systems to project costs of new systems. The historical data should be directly related to the system's performance characteristics. |
| Standardized Structure for the Estimate | • A standard work breakdown structure (WBS), as detailed as possible, should be used, refining it as the cost estimate matures and the system becomes more defined. A major automated information system program may have only a cost estimate structure.  
                                          | • The WBS ensures that no portions of the estimate are omitted and makes it easier to make comparisons to similar systems and programs. |
| Provision for Program Uncertainties     | • Uncertainties should be identified and allowance developed to cover the cost effect.  
                                          | • Known costs should be included and unknown costs should be allowed for.                                                                  |
| Recognition of Inflation                | • The estimator should ensure that economic changes, such as inflation, are properly and realistically reflected in the life cycle cost estimate. |
| Recognition of Excluded Costs           | • All costs associated with a system should be included; if any cost has been excluded, it should be disclosed and given a rationale.          |
| Independent Review of Estimates         | • Conducting an independent review of an estimate is crucial to establishing confidence in the estimate. The independent reviewer should verify, modify, and correct an estimate to ensure realism, completeness, and consistency. |
| Revision of Estimates for Significant Program Changes | • Estimates should be updated to reflect changes in a system’s design requirements. Large changes that affect costs can significantly influence program decisions. |

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**Figure 4**
Risk can be minimized by using a systematic approach to managing cost. This is accomplished through the application of cost engineering and cost management principles. Understanding and managing the costs requires skills and knowledge in business and program planning, cost estimating, and economic and financial analysis. (Hollman 2007)

The main sources of risk in a cost estimate are lack of understanding of requirements, misinterpretation of scope, misinterpretation of contract terms and conditions, haste in acceptance of unrealistic expectations. (Garrett 2008)

2. **Pricing Strategy**

In both public and private sectors there are two basic pricing strategies. (Garrett 2008)

a. *Lowest Price Technically Acceptable* (LPTA) - usually used in less technical projects, such as those more reliant on commodity type deliverables.

b. *Best Value Pricing Strategy* (BV) - used where the tradeoff between price and various aspects (quality, technology, etc.) is decided through extensive contract and verbal negotiations with the customer. It is at this stage of contract negotiation where contracting parties can reduce risk by administering the contract properly. (Garrett and Williams 2009)

The three methods that are typically used to determine price are: (Garrett 2008)
a. **Cost Based Pricing (CBP)** - The most simple and straightforward way of costing, based on the seller having an accurate and acceptable cost estimating system. There are no stringent rules for commercial companies on applying an appropriate profit as long as the process yields a fair and reasonable price. The key to applying the profit margin is how to properly balance risk versus opportunity.

b. **Value Based Pricing (VBP)** - This is the opposite of CBP. This method is applied when the value of a product or service to the customer is known. For example technology that is unique allows the seller to maximize a sales opportunity with the highest possible profit and maximum price paid by the buyer.

c. **Activity Based Pricing (ABP)** – A modified version of CBP. This method seeks to determine a fair and reasonable price based on costs estimated and what can be actually accomplished through activities and processes. ABP method allows to continually improving business processes, and works to benefit both sellers and buyers likewise, since it is aimed at reducing cost by improving processes. This method not only leads to higher profit margins but also allows lowering of prices to customers in the long run.

**Minimizing Margin Erosion**

Having researched the estimating of project cost, so far, the growth of a cost over the life of a project also needs to be addressed. To ensure the profitability of a project, a proper amount of contingency should be added into cost. (Lucas and White 2009)
The best approach to assessing the growth of cost over the duration of a project is by using analogous data from the past projects and analyzing it through multiple regression statistical analysis. Based on the accuracy of the input data, the risk of a project exceeding its budget can be predicted, hence allowing assessment of contingency funds or management reserves to be budgeted at the proposal stage. The greater the number of variables used in the model, the more accurately the model would yield contingency value. The accuracy of input data is the key to valid results. (Lucas and White 2009)
Chapter 3 – Research Procedure

This research was based in part on literature encompassing proposal development and cost estimating found in the University of Kansas library data base, the data gathered through customized questionnaires sent out to various departments within FMC technologies, and analysis of Local Work Instructions (LWI) on the quoting process at FMC.

At the beginning of the research process, information from previously written articles on the subject of cost estimating and proposals was gathered. Information derived from this literature highlighted the processes and concepts already in place in various industries. This information was used to develop recommendations for refining the cost estimating practices at FMC technologies. The collected information was developed in relation to “cost estimating”, the central theme of this research.

In order to determine the key factors of the cost estimating process presently employed at FMC Technologies, information was collected from several functional departments within the company. Four sets of questionnaires were developed and sent out to key personnel in each department to collect data on various aspects of project costing. This was done in order to understand proposal and estimate development from various perspectives. See Appendix A for the detailed questionnaires.

Out of seventeen questionnaires sent out, eight responses were received, meaning 47% of the surveyed personnel chose to respond. At least one response was received from each department. The completed questionnaires received were enough to provide many different perspectives on what needed to be incorporated in the revised LWI for estimating costs of proposals.
The LWI was analyzed in detail, examining alignment with the current quoting practices at FMC and the industry in general. The analysis of the LWI was performed to determine the areas that needed revision to include best practices in cost estimating and to remove all process steps that have become obsolete.

The recommendations in this report were developed by combining information extracted from literature research, questionnaire responses from the various departments within the company, and analysis of the LWI. The next chapter summarizes research results and recommendations.
Chapter 4 – Results

The results of the research are summarized in this chapter and divided into four sections. The first section includes the key findings from the literature review, which seemed particularly important to FMC Technologies’ current cost estimating practices. The second section goes into the details of key findings from the questionnaires sent to four departments within FMC. The third section discusses the results of reviewing the LWI on the quotation process at FMC. Last section covers recommendations, based on all the key findings, on how the quotation process and the LWI can be improved.

Key Findings from Literature Review

Out of all the concepts reviewed in the literature, the following are the concepts that could help improve the cost estimating practices at FMC, the most.

The barriers to accuracy of estimates include a lack of scope definition, poor communication, unrealistic internal customer expectations and optimistic team members. It is important that steps are taken to ensure these obstacles are cleared in order to better estimate the cost. (Lukas 2006) The steps that comprise the key functions and elements of a good estimate are as follows: (Lukas 2006)

1. Never estimate alone. Multiple reviews and opinions are better.
2. Appropriate amount of contingency should be added, in terms of money and time.
3. Estimates should not be exact numbers, but a range of possible costs. The worst case number should precede the best case figures.
4. All assumptions and exclusions should be documented, in order to prevent scope creep.
5. All direct and in-direct costs per project scope should be included to prevent margin erosion.

6. An effective cost estimator should have either direct knowledge of material and labor costs or a good relationship with the appropriate people who can provide this information.

7. Estimating cost is directly related to cost of quality, so involvement of the quality department is also important.

8. Use of good estimating software adds value to cost estimating.

The estimator needs to educate both the project team and the client on the type of estimating method used and its typical accuracy range, based on the amount of scope definition (available): (Lukas 2006)

1. **Order of Magnitude**- These estimates have minimal accuracy, since they are prepared with limited information.

2. **Conceptual Estimates**- These are only 50% accurate since these are pre-study estimates.

3. **Budgetary**- These estimates are 70% accurate and are often prepared to support project funding request. These are very common in the Oil & Gas industry.

4. **Detailed or Defined Estimates**- These are 85% accurate because they are prepared when most of the project definition is known. (Lukas 2006)

5. **Control or Check Estimates**- These estimates are usually prepared when project is completely defined.
**Pricing Strategy**

Selecting the right pricing strategy is the key to a profitable and yet competitive bid. The three methods that are typically used to determine price are: (Garrett 2008)

1. **Cost based** - Based on seller having an accurate and acceptable cost estimating and accounting system as per GAAP. The key to applying the profit margin is how to properly balance risk versus opportunity.

2. **Value Based** - This is applied when the value of a product or service to the customer is known.

3. **Activity Based** - This method seeks to determine a fair and reasonable price based on costs estimated and actually accomplished through activities and processes.

**Key Findings from Questionnaires**

Customized questionnaires were sent out to Quotes, Project Management, Sourcing and Business Development departments within FMC. All questionnaires included request for suggestions on improving the current estimating practices at FMC.

**Quotes Department**

*Goal* - The goal of collecting data from the quotes department was to first legitimize the need for this research, based on the number of proposals prepared versus the ones that actually won contract awards. The questions focused on gathering details on the percentage of proposal failures vs successes.

*Key Findings* - Data received from the Quotes department was convincing enough to justify the need for this research for FMC. The ratio of
proposals that won business award to the aggregate number of proposals prepared was astounding. During the high point in the Oil and Gas industry’s business cycle, 61% of the proposals generated did not result in a project, and during the ebb of the cycle, up to 80% of the efforts were fruitless.

However, the proposals that did not come to fruition were not all lost to competitors. Many were either postponed by the customers or were never awarded for execution to any company. Despite these facts there is still need to optimize the bidding process to minimize the time and resources spent on bids.

Suggestions - Per the quotation manager, in order to improve the current quoting practices, attention to strategy should be increased, and competitive analysis should be performed earlier in the process.

Project Management Department

Goal - Information from project management was gathered to determine the primary sources of margin erosion, so they can be controlled at the proposal development stage. The questionnaire focused on finding the root cause of margin erosion and the customer’s reaction to revision of cost. The aim was to obtain information that could help determine the cost drivers over the entire span of a project. Knowing the factors that drive up the cost of a project can assist with adding the right amount of contingency.
**Key Findings** - Three project managers responded with varying comments. Two out of three chose scope creep as the biggest factor, followed by underestimating time requirements and unrealistic appraisal of in-house capabilities.

Per the response to the questionnaires, no matter how good the relationship with the customer, any margin erosion suffered due to misunderstanding customer requirements is difficult to recover. Customers resist any variation order other than the changes that they initiate themselves.

**Suggestions** - Project managers suggested that, in order to improve the quote process at FMC, standard processes for quoting need to be created. It is easier to catch any missing specifications or requirements, if the same format is followed for all customers and projects.

**Sourcing Department**

**Goal** - This questionnaire was aimed to understand how customers value FMC by understanding how FMC values its suppliers. Questions were compiled to find out which aspects of the suppliers’ proposals are important to customers.

**Key Findings** - FMC uses a Supplier Performance Index (SPI) to rate and choose suppliers. This SPI takes a supplier’s score and applies a penalty for poor quality and delivery. For example, one supplier bids $100 and has as SPI of 1.40 while another has a bid of $120 and an SPI of
1.10. The bids are evaluated as a total cost of $140 for the first supplier and $132 for second supplier. Business would be awarded to the second supplier based on a “total cost of ownership”. Quality has twice the impact as delivery. Hence, the lowest bid is not always the lowest total cost solution. Non conformances, engineering time spent on resolving issues and the time spent managing the supplier, all cost money.

According to the sourcing manager, the most important aspect that companies look for in competing proposals is realistic appraisal of capacity and capabilities. Competitiveness is important, but not without looking at how a supplier tracks capacity. The supplier could be giving a great deal on a part that might not be delivered in a timely manner. In slower economic times, many suppliers are willing to take work that is not within their core competency, just to keep revenue coming in.

Suggestions – The sourcing manager recommended that most emphasis should be placed on carefully calculating lead times for components. On Time Delivery (OTD) is also an industry-wide gauge that is used to measure the credibility of a company. Contingencies for changing material costs and schedule fluctuations also need to be incorporated at the proposal stage.

Business Development Department

Goal- The business development group is in direct contact with the customer more than any other group within FMC. Hence, their input is
critical as it relates to proposal and estimate development at FMC. The questionnaire was compiled with query pertaining to customers' positive and negative feedbacks. This query was expected to help determine the level of quality of a proposal that is needed to win a contract award.

**Key Findings** - The aspect of “cost” resonated throughout the responses. Per the Business Development Managers (BDM), the priorities of customers change with the changes in the economy. Cost is the most important factor during economic down turn, while lead-time and scope compliance are the dominant aspects of the proposal, in a strong economy.

**Suggestions** - For improvements in the current quoting practices at FMC, the BDMs suggested that market dynamics be considered. Significant rapid growth in business volume at FMC has contributed to the in-efficient costing practices. The leadership at FMC needs to work harder on reducing the learning curve, so transition in costing is smooth through long term agreements. Another suggestion included devoting more energy to defining the scope more clearly, and to leverage engineering efforts at other FMC locations to drive project costs down.

**Key Findings from LWI Review**

After reviewing the LWI for the quoting process at FMC, the following issues were found:

1. The section of the LWI that defines the steps of estimating the cost of projects needs to be completely overhauled to align with the current practices at FMC.
2. All references made to loading the quote into the SAP (FMC’s enterprise resource planning system) are obsolete.

3. The LWI is tailored to cater to only one product group so the document cannot be used as a standard guideline for the quoting process in all FMC locations.

4. The LWI lacks proper definition of roles and responsibilities of the personnel involved in cost estimating.

5. Terminology and acronyms used in the LWI are outdated.

**Recommendations**

The following recommendations were compiled based on the ideas collected from literature research, and suggestions obtained from various departments within FMC. The resulting recommendations are categorized under five subsections for clarity.

1. **Recommendations on Improving Communication**

   a. In order to optimize the bidding process, quotes department needs to start with a brief project-kickoff meeting, with only the key players. This is a current practice at FMC. However, the number of people invited to the meetings is too large. The quotes department needs to re-visit their procedures and streamline the invitation list to only the key players at each stage of the quote. This would minimize the number of man-hours spent on preparing a bid.

   b. The scope should be defined precisely and clearly. All the information should be delivered in a standard FMC format electronically and hard copy. The request for quote and all documents related to that quote should
be put on an intranet site accessible by all members of the proposal team, in the bid phase of the project. Currently each proposal coordinator is presenting the scope in different ways. No hard or electronic copies of the presentation are provided to the estimators in product group. This leads to missed information.

c. The BDMs should observe the customers closely to determine what the customers really need versus what they say that they need. It is at this point in time that any unreasonable expectations of the client should be dealt with through clarifications.

d. The best approach to avoiding scope creep is for cost coordinators from each product group to establish good communication with the project team, in order to obtain the information needed to prepare quality estimates.

2. **Recommendations for Standardization**

   a. A standardized cost estimating procedure is important. Using an estimating template to fill out the scope in detail is one way to ensure customers requirements and expectations are thoroughly captured.

   b. A standardized CTR form, either in Excel format or a customized estimating software package, is essential to thoroughly capture the scope of the project. Having a standard form across all locations and groups would also make it easier for the proposal coordinator to extract data more efficiently from the CTRs submitted by various product groups.
c. The systems engineer determines the major deliverables needed to meet customers’ requirements. This comprehensive list of deliverables is called the Master Equipment List (MEL). The standard cost estimating form should be tailored according to each unique MEL, keeping the basic standard structure of the template. Keeping the CTR form in the same format as the MEL would prevent any pertinent information from being lost.

3. **Recommendation for improvement of Processes & Practices**

a. It is better to estimate with a knowledgeable team versus as an individual. It should be mandatory to have at least one internal cost review within each product group before the general company review. This helps gather various opinions and ideas on what contingencies need to be include to handle scope changes that might not be evident at proposal stage. Having several reviews would ensure that all the assumptions, exclusions, direct and in-direct costs have been included. It is also important to include the group’s quality engineer in the CTR reviews, since estimating cost is directly related to the cost of quality.

b. When preparing cost estimate based on new cost data from multiple suppliers, the cost estimator should ensure that the supplier’s track record for on-time delivery is good before using the lowest cost. Proposals play an important part in establishing a company’s OTD track history.
c. Care should be taken when stating a lead time. It should be aggressive but should include delivery contingency (buffer) based on previous experience. Lead time should be quoted as a range like the price, with the worst case mentioned before the best case lead time. To compensate for potential delays from sub-tier suppliers or other unforeseen circumstances, some contingency should be added. This contingency is for money kept aside for parts that need to be expedited or re-worked. The cost of expediting or re-working parts is also a significant factor in margin erosion, since it drives up the material cost of the product.

d. With a common engineering database, all engineering changes or projects should be visible to all FMC locations. In order to leverage engineering efforts at other FMC locations, engineers at all locations should be trained to look through a common area of design work in progress to avoid redundancy. A good communication channel should be open in the form of a global forum for engineers, from where they can draw from each others’ experiences and research to avoid duplicating engineering work and hence unnecessary additional cost.

e. In order to keep up with market dynamics the common industry indices are studied and employed by the quotes group in order to determine price. In previous years FMC was lagging in the market price curve. With a combination of increased industry intelligence and feedback from the account managers FMC should re-align it’s costing and pricing with the rest of the subsea oil production equipment industry.
f. A good pricing strategy should be chosen. Pricing strategy is dependent on the relationship with the customer, and dependant on whether an open alliance relationship or the bid is a strategic one.

4. **Recommendations on improving SAP information**

   a. A company-wide effort needs to be conducted to ensure that all SAP data, comprised of costs and labor times, is correct. This will make the quoting process much simpler and quicker. If the standard cost estimating spreadsheet or software draws data directly from SAP, and if that data is completely accurate, it would make the quoting procedure more efficient and shorten the learning curve for new employees.

   b. Lead times in SAP also play an important part in margin erosion. Component lead times should be corrected to enable accurate delivery date estimation without expediting costs.

5. **Recommendations on Revising the LWI**

   a. The concept of standard quotation template needs to be introduced along with instructions on how to populate the form with actual and accurate data from SAP.

   b. A section defining the roles and responsibilities of the people involved in cost development needs to be added.

   c. The quotation checklist in the LWI needs to be revised to include all the steps that lead to minimizing scope creep and hence margin erosion.
d. The LWI needs to be tailored to cater to the needs of all product groups so one document can be used as a standard guideline for the quoting process in all FMC locations.

e. All outdated terminology and acronyms used in the LWI need to be revised and updated for clarity.

The value in following these recommendations is a more robust cost estimating process at FMC technologies which is aligned with the best practices in cost engineering. These recommendations would also lead to reduction in margin erosions and improved profitability.

In the past few years, incorporating some of the recommended practices within one product group has demonstrated a positive increase in profit margins. Following these recommendations company-wide seems promising and will result in “Winning Cost Estimates Yielding Long-run Profitability”.

________________________________________________________________________
Chapter 5 – Suggestions for Additional Work

The following are some suggestions for additional research work that can be performed by someone at FMC Technologies to further the research discussed in the previous chapters.

The revised LWI should lead to standardization of the quoting practices at the FMC Technologies, across all product groups in Houston. This would help the quotation group decipher and pull information from various groups’ cost estimates into the final proposal, more quickly and efficiently. It would be interesting, to observe the results of this standardization in terms of assessing, how much reduction is realized in the time to develop a quote.

In addition to the research just completed, it would be beneficial to create a Global Work Instructions (GWI) for quotation process to standardize practices at all global locations. Extensive research would be needed to determine the best way to accomplish this as regional requirements would likely add steps to the process.

Another realm that is left to be explored is the “Proposal Development”. This research was focused more on the cost estimating facet of proposals, but there is much more involved in the compilation of the final proposals, submitted to customers, than just the cost estimate. There is no LWI at FMC technologies defining and standardizing the process of proposal development. This would require exploring the requirements of various customers served by the various FMC locations.
APPENDIX A

Project Managers’ Questionnaire

1. What has been the predominant factor leading to margin erosion?
   a. Scope Creep- Failure to understand customer requirements
   b. Unrealistic appraisal of in-house capabilities
   c. Underestimating time requirements

2. What feedback have you received from the customer regarding this issue? How willing are they to allow cost revision?

3. Any ideas or recommendations for improving our current quoting practices?

Sourcing Managers’ Questionnaire

1. Besides low cost and shorter lead time what factors lead to awarding business to a vendor?

2. What key aspects do you look for in competing proposals when you have to choose one vendor from a pool?

3. If ever, when do you take exception to the cost or lead-time factors when choosing a supplier?

4. Any ideas or recommendations for improving our current practices?

Proposal Managers’ Questionnaire

1. Based on the past 2 years, what is the ratio of successful vs failed proposals?

2. What is the feedback you have received regarding winning proposals?

3. What is the feedback you received regarding proposals that failed to win business?
4. Any ideas or recommendations for improving our current quoting practices?

**Business Development Managers’ Questionnaire**

1. Please highlight- In the past 2 years ….

2. What have been the dominant factors behind the **bids** that we **lost**?
   a. Cost
   b. Lead-time
   c. Scope deficient
   d. Freight cost
   e. Lack of manufacturing facility in the region desired by customer (local content)

3. What were the factors behind the **winning** bids?

4. What are the customers’ impressions of our costing strategy?

5. What is “your” perspective of our costing strategy? Do you agree w/ the customer?

6. Any ideas or recommendations for improving our current practices?
References/Bibliography


