WHITE PAPER

SHOULD COSTING ON A LARGE SCALE WITH FAST TURNAROUND

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Executive Summary

Globalization and advances in manufacturing are forcing manufacturers to review and reduce the cost of manufacturing the products. There is a need to identify opportunities for cost reduction through value engineering and sourcing strategies. Here, should costing – the ability to determine a fair and reasonable price for parts – is emerging as a critical source of data to improve the pursuit of these opportunities. Unfortunately, traditional should costing approaches require considerable amount of effort and experienced personnel involvement to derive accurate product costing, leading to scalability challenges for large-scale implementation.
This paper elucidates an innovative should costing approach to overcome the challenges. Advances in machine learning techniques and analytical frameworks are leveraged to develop intelligent cost models and improved interpretation of the cost estimates. The approach encompassing the new cost models, manufacturing process guidelines, exhaustive database, and process automation allows implementation of should costing at a large scale in a short span of time.

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Current approaches and challenges

Should costing is a scientific technique that can determine the manufacturing cost of any part or product with respect to various cost components such as raw materials, labor, equipment, tooling and production overheads. Typically product should cost estimation leverages two traditional approaches:

1. **Detailed costing** –This is a feature-based costing that uses commercial off-the-shelf (COTS) software or Tools and templates developed in-house. While it provides high accuracy and detailed breakdown of cost, it requires a thorough understanding of engineering requirements, manufacturing process sequences and supply chain management (SCM) strategies.

2. **Quick estimate** – This costing approach uses empirical methods (analogous, trends or regression analysis) to estimate the rough order of magnitude (ROM) that is needed to determine the cost for a large number of parts within a short time. It allows users to estimate cost through limited engineering inputs, thereby reducing the effort spent in developing cost estimates. However, it requires a large set of historical data as well as expert judgment.

Traditional approaches have some limitations for large scale implementation with fast turnaround as shown in table 1.

Detailed Costing	Quick Estimate
Availability of large number of input data, its collation and management	Less accuracy as only few parameters that impact cost are used in prediction
Requires sizeable resources such as tools, infrastructure and a skilled workforce	Predicted cost is sensitive to the parameters selected
Need for tailor-made templates for various manufacturing processes	Laborious process for parameter inclusion/update
Consistency in costing reports due to dependency on multiple variables such as geography, labor rates and material rates	Lack of standardization across manufacturers and industries
Extensive manual intervention and high dependency on SMEs	Low confidence in the predicted cost

Table 1: Limitations of traditional should costing approaches

Need for a new approach

Different manufacturers, and even different units under a single manufacturer, use cost estimates differently. However, the individual detailed cost estimates for most of the parts will satisfy the requirements of the manufacturers and provide better leverage during supplier negotiations. Further, a detailed cost estimate will help organizations continuously improve their sourcing strategies such as make-or-buy decisions, purchase consolidation, supplier negotiations and procurement from low-cost manufacturing locations. Unfortunately, traditional approaches pose challenges to meet these expectations in large-scale implementations with fast turnaround necessitating manufacturers to explore alternate approaches.

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Infosys cost analytics framework

Infosys has developed a **comprehensive cost estimation framework** that leverages their expertise in should costing across various industries and well established costing process. When building this framework, the key levers identified were innovative cost models, large database for rate information across various geographies, guidelines encompassing all major manufacturing processes, and automated tools/templates for large-scale implementation.

The Infosys **cost analytics framework** establishes a robust co-working model with well-defined entry and exit criteria for seamless costing processes. It allows users to:

- Build a reliable costing methodology
- Develop a repository of cost templates based on detailed costing results
- Collate knowledge/experience to design rules and guidelines for costing
- Provide detailed cost reports with information on each cost component to enable effective supplier negotiation

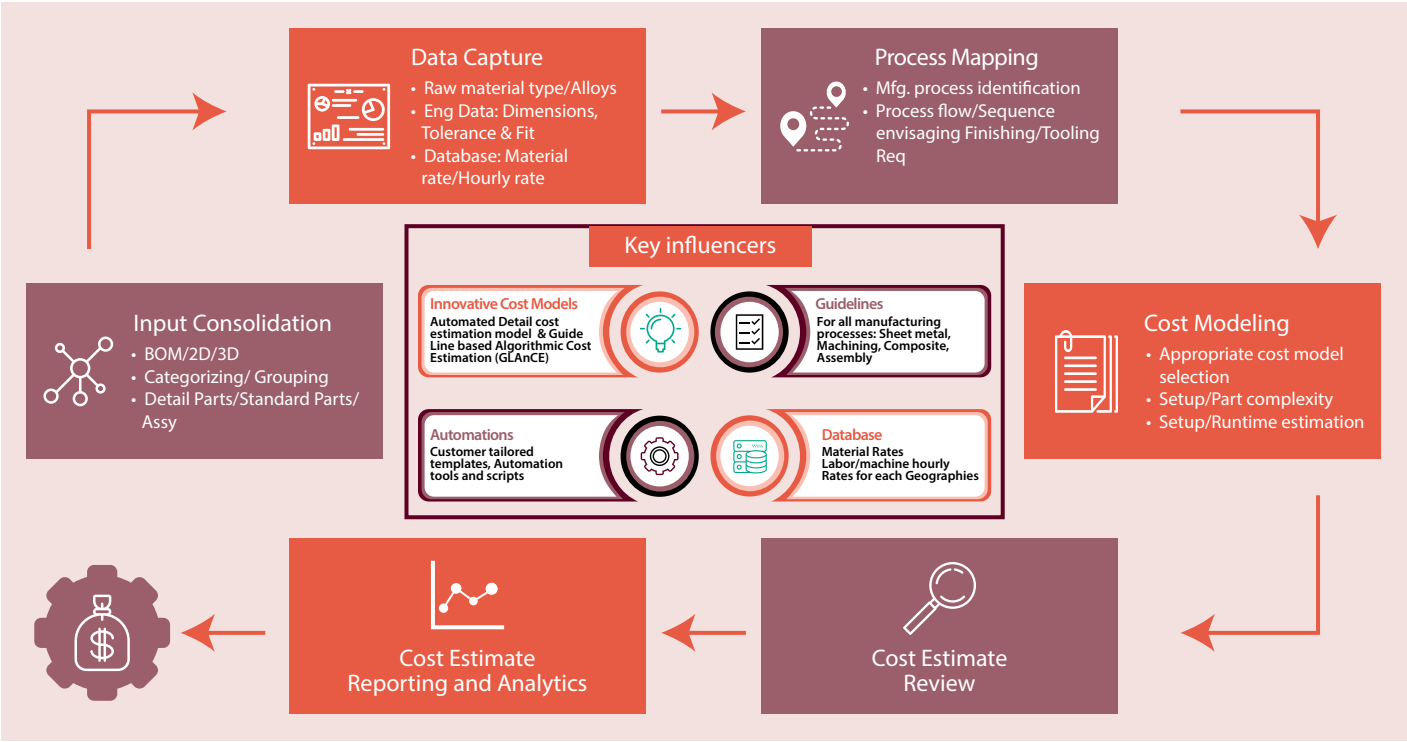

Figure 1: The Infosys cost analysis framework

The unique features of the framework such as innovative cost models, guidelines, automation, and dynamic cost database ensure minimal manual intervention, scalability of teams and higher accuracy, thereby providing consistency and uniformity in costing.

Innovative cost models

To meet the diverse expectations of manufacturers such as fast turnaround, detailed cost breakdown, consistency and accuracy, the cost analytics framework incorporates the following innovative cost estimation models:

Automated detailed cost estimation – This is a detailed costing approach that leverages automation at various stages such as data capture, data entry for costing tools, knowledge templates for the manufacturing processes, and customized report generation. It provides greater effort savings while retaining the same accuracy in detailed costing. However, incorporating modifications require additional customization effort.

GuideLine-based Algorithmic Cost Estimation (GLAnCE) –This is a algorithmic model developed by analyzing computed cost estimates and established guidelines that determine various cost components with minimal user input. It helps to reduce effort and scales easily in a short span. However, it necessitates detailed reviews and refinement on case to case basis.

Machine learning based cost estimation – Artificial neural network techniques are used to develop very quick and accurate cost estimates. This method can be applied after large number of detailed cost estimates are available, where selected set of input parameters are mapped to the cost components using machine learning techniques.

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Guidelines

Infosys developed exhaustive methodology documents called "Guidelines" for each of the primary manufacturing process categories such as machining, sheet metal, composite and assembly. Guidelines cover, various manufacturing process sequences and best-practices, material excess criteria, material removal rate and typical set-up/run times in relation to part size and complexities. These documents are developed by conducting rigorous analysis and leveraging SMEs' experience. With these Guidelines, users can follow the proper costing procedure for higher costing accuracy and uniformity.

Automation

Infosys leveraged their knowledge-based engineering (KBE) capabilities to capture the rules and knowledge of cost estimation processes within a software application for the cost analytics framework. This application is built using tools and methodologies that embed guideline requirements along with client-specific inputs. It increases the agility of change implementation, enhances productivity and ensures consistent outcomes across different costing teams. It helps user to interactively update and perform what-if analysis in the cost estimate templates.

Database

Infosys has developed an exhaustive cost database for various geographies that comprises of data such as raw material rates, machine hourly rates, and labor rates. The database is regularly updated with the latest inputs to ensure that the most recent data is used to develop the cost estimate. Some of the major input sources for the database are shown below:

- Quotes from manufacturers
- Web subscription
- Supplier interaction
- Manufacturer website

Material rate

- Supplier interaction
- OEM inputs
- M/C Tool price based calculation

Machine hourly rate

- Bureau of Labor Statistics
- Supplier interaction
- Research reports
- Web subscription

Labor hourly rate

Reporting

The framework enables to generate cost estimates containing a breakdown of total product cost with various cost components for suppliers in specific geographies. The cost estimate lists out various elements such as part attributes, material cost, manufacturing cost, processing cost, consumable cost, tooling cost along with setup time and run time for each of the process sequences. A detailed analysis of the cost estimate helps users identify the key cost drivers for specific groups of parts. With these insights, manufacturers can take proactive steps to reduce cost through supplier negotiation, value engineering and design-to-cost initiatives.

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Case studies

A well-managed should costing solution enables continuous cost management and waste elimination, thereby improving cost efficiencies. A set of case studies are provided where the Infosys cost analytics framework enabled manufacturers to achieve a competitive edge.

Enabling a network hardware manufacturer in design to cost initiatives

Infosys collaborated with a leading US based networking hardware and telecommunication equipment manufacturer to develop an approach for estimating the should cost for their globally sourced parts. The solution required an approach to estimate the should cost for both electro-mechanical parts and assemblies. Infosys leveraged the cost analytics framework and executed the program within 8 weeks for large set of diverse products.

- Potential annual saving were tabulated enabling the manufacturer to prioritize products for negotiation
- Detailed estimates enabled customer to make effective supplier negotiation which could reduce the purchase cost by 10 to 40%
- Identified design to value initiatives to help their suppliers reduce cost of manufacturing

Accelerating the cost reduction initiatives of an aerospace manufacturer

A leading American aerospace manufacturer partnered with Infosys to develop a strategy and adopt cost estimates for a large section of their product portfolio. The main challenge was to develop cost estimates within a short turnaround time for thousands of parts and assemblies that were sourced from different geographies.

Infosys leveraged the cost analytics framework to:

- Develop product cost estimates with detailed breakdown of cost components to form a baseline for value engineering and design-to-cost initiative
- Provide a large repository of cost estimates across multiple programs, enabling the client to estimate product cost during early design stages even in the absence of detailed engineering information.
- Establish a set of process documents, guidelines and metrics that serve as standard references for future aircraft programs.

The Infosys solution helped the manufacturer to realize substantial cost savings by

- Changing sourcing locations to low cost manufacturing country
- Supplier negotiations with accurate cost estimates for each and every parts /assemblies
- Structured should costing practices within short span

Benchmarking should costing practices of an automotive manufacturer

Infosys engaged with a global leader in commercial vehicle braking, stability, suspension and transmission control manufacturer for estimating the cost for their product ranges and benchmark their internal should costing practices within their units. The solution required to develop part should cost, based on the most-efficient (lowest cost) manufacturing processes considering variable production volumes, materials, and different geographies. Infosys leveraged the cost analytics framework and executed the program within 6 weeks' time

- Cost reduction initiatives implemented by leveraging detailed costing of parts and assemblies, yielded cost savings of 25% over the current design
- Should costing and value engineering solution enabled client to be more competitive in the entry level car segment

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Conclusion

Today, manufacturers face tremendous pressure to reduce cost. By predicting and understanding the cost of parts and components, manufacturers will be able to identify opportunities for cost reduction. This discipline, known as should costing, has various traditional approaches that has some limitations to deliver beneficial outcomes for product cost management processes in large scale with fast turnaround. To help manufacturers achieve tangible benefits, Infosys has designed a simple and scalable cost analytics framework to perform detailed should costing in an efficient way. It helps to optimize the cost management strategy of new and existing products, helping manufacturers stay competitive.

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