IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 6, August 2014.
www.ijiset.com
ISSN 2348 – 7968

Benchmarking - The First Step for Frugal Engineering

S. Rajadurai[1], C. Parameshwari[2]

[1]Head-R&D, Sharda Motors Industries Ltd, Mahindra City, New Chennai
[2]Project Executive-R&D, Sharda Motors Industries Ltd, Mahindra City, New Chennai

Abstract

In this article, we have defined a systematic benchmarking process, the first step to perform Frugal Engineering, the science of breaking up complex engineering process into the basic components and then re-building each component in the most economical manner to achieve a simpler, more robust and easier to handle final product. The meaning of benchmarking is clearly defined and distinguished from competitive and comparative analysis and value targeted product proposal. Types of benchmarking, system selection process and the sequential steps of benchmarking are clearly discussed. Benchmarking process is a pre-requisite for Value Analysis and Value Engineering (VA/VE). An example of an automotive exhaust system muffler benchmarking is explained in detail. The article is concluded with the other steps of frugal engineering such as technical competitive analysis, commonization and standardization and value proposal of a system to strive to be the best of the best, the essence of frugal engineering.

Keywords: Benchmarking, Technical Competitive Analysis, Commonization, Standardization, Value Proposition, Frugal Engineering.

1. Introduction

The decade of 2010s is the Decade of Frugal Engineering as the first decade of 2000 is the decade of Globalization. Continuous change in new product development is mandatory to be competitive in the known market places of today and the expected markets of tomorrow. Frugal engineering is necessary to demonstrate the competitive advantage and the simplicity of a product [1]. Long range strategies, if not survival, requires product development protocols to implement innovation and frugal engineering. Benchmarking is the first step among the several success passage steps of frugal engineering [2].

2. What is Benchmarking ?

Benchmarking is a technique followed to understand the status of a product or process which is in practice and can be used to develop or improve the value of it. Benchmarking is more an art than a science.

Benchmarking leads to a deep understanding of the processes and skills that create superior performance. Without this understanding, little benefit is achieved from product engineering. It is a method which helps to compare various processes or product to improve performance and value. Benchmarking is a positive, pro-active process to understand a product in a structured fashion to achieve superior performance [3, 4]. Benchmarking is not an end-all process. It is the beginning of change. Just benchmarking financial results alone will not help to complete the task. Before beginning benchmarking process, we must understand the goals and objectives. Risk analysis should be performed along wih the mission and goals. Risk management vary from entity to entity. Benchmark must relate to risk management goals. We need to measure things which indicate if we are accomplishing our goals or not.

3. Why Benchmarking ?

There are many reasons why we should actively consider benchmarking while proceeding for best product development. No product is the best at every element considered. There is a need to search for good, promising, practical and better if not the best product always. The best performer needs to be captured, transferred and adopted throughout the development stage though it involves series of hurdles. Benchmarking exists to overcome the obstacles in a disciplined way. Benchmarking brings rigor to the approach in setting goals overcoming these believes, assigning accountability and speeding up culture change [5, 6]. Benchmarking is the only way to create a sustainable and continuously improving product performance and value. In this article, we are giving definition for various elements involved in the total product development. We consider benchmarking being the first step for frugal engineering. Figure 1 illustrates the sequential steps involved in frugal engineering. We urge the need for a step by step systematic approach to achieve Value Target (Performace / Cost) by frugal engineering. Benchmarking is the first step for any new initiatives as well as continuous improvement of the existing product.

ISSN 2348 – 7968

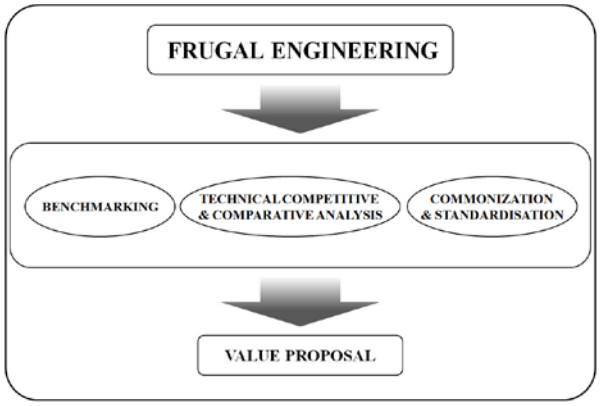


Fig. 1 Benchmarking - First step of Frugal Engineering

4. Types of Benchmarking

Benchmarking technique can be broadly classified as process benchmarking, performance benchmarking and strategic benchmarking. Benchmarking can be internal: comparing performances between different groups or teams within an organization or external: comparing performances with companies in a specific industry or across industries. The terms benchmarking and competitive analysis are often confused and synonymously used. Benchmarking researches external business sectors for information whereas competitive analysis shows how firms compare with their competitors.

5. Benchmarking Procedure

Conventionally seven step procedure is followed for benchmarking as described by Kaiser Associates [1]. A revised procedure using twelve steps process is considered by Robert Camp [2]. We are considering a sequential ten step process for benchmarking an automobile exhaust system.

1. Identify a system
2. Classify a system
3. Acquire a system
4. Define a procedure
5. Priorities activity
6. Analyze the system
   a. Dimensional measurement
   b. Performance analysis
7. Improve the system
8. Implement the system
9. Inspect the system
10. Manage the system

6. System Selection Process

Benchmarking system selection process is the most critical step in the study. The system selection should cover products from all sources such as internal, external, competitors etc. Various similar performing and comparable parts should be included in the study. Figure 2 below illustrates the systematic steps of system selection process.

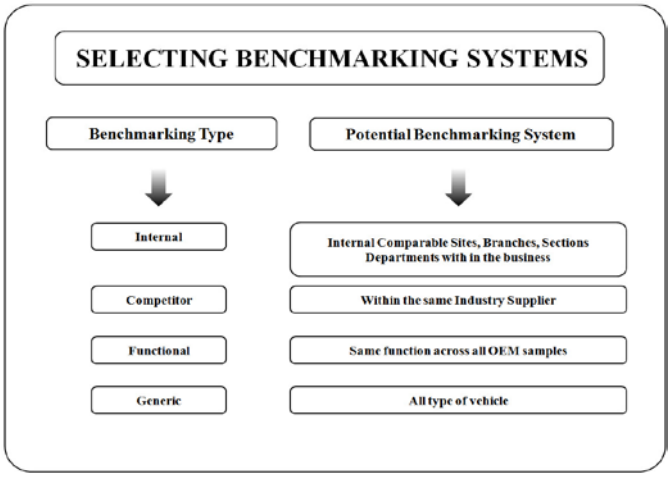


Fig. 2 Selection of Benchmarking Process

7. Example of Benchmarking

The sequential steps of the Automobile Exhaust System benchmarking are illustrated in figure 3. The stepwise procedure is followed to study the system dimensional analysis and performance study. Then Tear-Down analysis is performed on the internal components. The documentation is completed in a specific template.

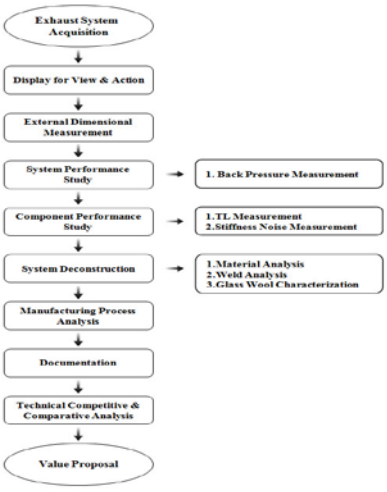


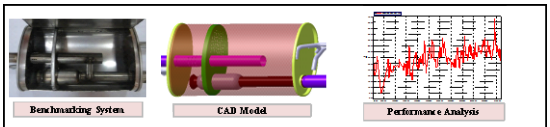
Fig. 3 Sequential Steps of Benchmark

ISSN 2348 – 7968

8. Benchmarking to Frugal Engineering

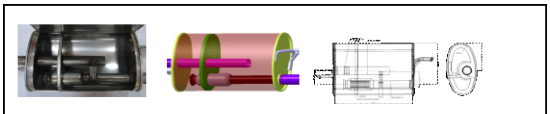
The results of benchmaring are documented in a specific template as shown in Table 1. The documented details are then converted into component based value document by technical competitive analysis (Table 2). In this step, value comparisons of similar application oriented products are studied and competitive values documented. The value proposition for a new application is then derived to achieve Frugal Engineering.

Table 1: Benchmarking documentation



S.No	Component Name	Images	Specifications	Dimension
1	Shell		SUS 439 L-CP	375Lx605Wx1.0t
2	End Cap - Inlet		SUS 409L-CP	299Lx187Wx1.2t
3	End Cap - Outlet		SUS 409L-CP	298Lx186Wx1.2t
4	Baffle Plate		SUS 409L-CP	265Lx155Wx1.0t
5	Inlet Tube		SUS 409L	258Lx115.61Wx1.0t
6	Inbuilt Resonator Shell		SUS 409L-CP	326Lx35.2Wx1.0t
7	Outlet Tube		SUS 409L	122Lx20Wx1.0t

Table 2: Value proposition



S.No	Component	Material	Comparison	Value Added
1	Shell 375Lx605Wx1.0t	SUS 439 L-CP	Other benchmarked systems from similar applications are compared	Shell shape commonization, material change etc.
2	End Cap- Inlet 299Lx187Wx1.2 t	SUS 409L-CP		Thickness, Geometry, Process etc.
3	End Cap - Outlet 298Lx186Wx1.2t	SUS 409L-CP		Thickness, Geometry, Process etc.
4	Baffle Plate 265Lx155Wx1.0t	SUS 409L-CP		Thickness, Geometry, Process etc.
5	Inlet Tube 258Lx115.61Wx1.0t	SUS 409L		Thickness, Geometry, Perforation, Process etc.
6	Inbuilt Resonator Shell 326Lx35.2Wx1.0t	SUS 409L-CP		Size, Shape, Orientation, Process etc.
7	Outlet Tube 122Lx20Wx1.0t	SUS 409L		Thickness, Geometry, Perforation, Process etc.

9. Conclusions

The requirement of Frugal engineering for the dynamic and challenging technical world is clearly defined with various elements involved. Benchmarking is clearly discussed and differentiated from Technical Competitive Analysis and and Value Proposition. The sequential steps of an automobile exhaust system benchmarking is detailed. The need for commonization and standardization for value proposal is explained. An example of a muffler component benchmarking and value analysis is discussed. The results are summarized. Further studies are planned for frugal engineering.

Acknowledgement

The authors acknowledge Sharda Motor R&D staff for their continued support on Benchmarking. The authors acknowledge A. Gowtham and S. Balaji for their assistance.

References

[1] www.lifehealthpro.com/.../**frugal**-innovation-lessons-from-**carlos-ghosn**

[2] Camp, R.(1989). The search for industry best practices that lead to superior performance. Productivity Press.

[3] Beating for competition: a practical guide to benchmarking (http://www.kaiserassociates.com/cs/first_book_on_benchmarking) Washigton, DC: Kaiser Associated. 1988.p. 176. ISBN 978-1-56365-018-5.

[4] Camp, Robert C. Global cases in Benchmarking: Best practices from Organizations Around the World. Milwaukee, Wisconsin : ASQ Quality Press, 1998.

[5] Bogan, C.E. and English, M.J. (1994). Benchmarking for Best Practices: Winning through Innovative. New York: mcgreaw-Hill.

[6] Del Giorgio Solfa, F. Benchmarking en el sector public: aportesy propuestas de implementacionparalaprovincia de Buenos Aires (la Ed.). Villa Elisa: Industry Consulting Argentina. 2012

First Author Dr. Sivanandi Rajadurai

ISSN 2348 – 7968

Dr. Sivanandi Rajadurai is the President and CEO and Head of R&D Sharda Motors Industries. Dr. S. Rajadurai has devoted nearly 35 years to scientific innovation, pioneering theory and application through the 20th century, and expanding strides of advancement into the 21st century Dr. Rajadurai's innovations in catalysis have generated significant academic and industrial value. By authoring hundreds of published papers and reports and creating several patents, his research on solid oxide solutions, free radicals, catalyst structure sensitivity, and catalytic converter designs has revolutionized the field of chemistry. As a corporate executive in the United States and India for over three decades, Dr. Rajadurai managed strategy on power train development and emission control for low- and partial zero-emission systems, and carbon dioxide balance.

Second Author Ms. C. Parameshwari, Project Executive

C.Parameshwari is a Porject Executive at Sharda Motors R&D since 2012. Parameshwari completed B.Sc. at SRM University in 2006 and MCA at Sathyabama University in 2010. She worked at Saint Globetain on Data Base Management System prior to joining Sharda Motor R&D. She has specialized in SQL and .Net. She is involved in the program management team for Cummins Power Generation projects. She is also working as a project executive for scheduling and managing R&D functional propgram activities including benchmarking. She is a memebr of the advanced development projects from concept to manufacturing.