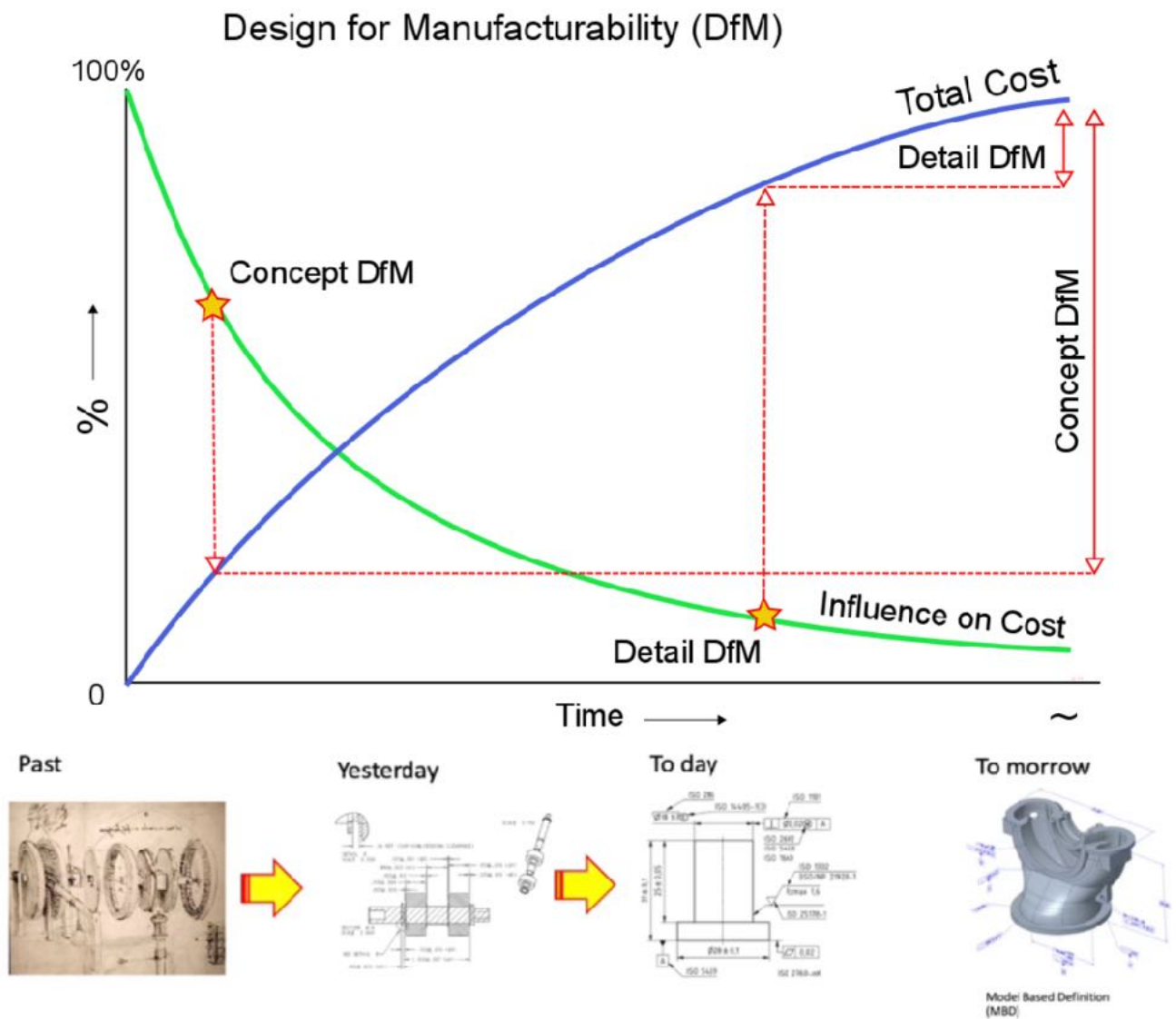


Design for Manufacturing (DfM) Influence on Quality and Cost.

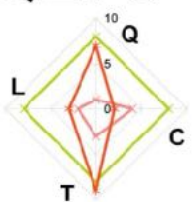
Gateway to manufacturing knowledge.

Insight into the production aspect of the design.



QLTC

Balanced



- Q uality
- L ogistic
- T echnology
- T otal C ost

LAURENS VAN LIESHOUT

“Design is modeling the future.”



Design for Manufacturing (DfM) Influence on Quality and Cost. Gateway to manufacturing knowledge.

Insight into the production aspect of the design.

Laurens van Lieshout

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Any liability and any damage that arises as a result of using the method described here is excluded. I do like to hear compliments. The book has been compiled with the utmost care. It may nevertheless contain errors and/or imperfections. If so, I'd like to hear about it.

All drawings without source reference are made by me.

Preface

The book provides insight into the **production aspect** of the design process. The book is also the **gateway to production knowledge**. You will find an overview of all manufacturing processes with a 130-link to YouTube films explaining them. The content of this book is based on DfM and DFA workshops.

Why this book?

As lead engineer and project leader I often had to explain to the team members what their role is in the design process. Also, the manufacturers, the makers of the products, who were involved in the design at an early stage, had no idea of their role in the design process. Very little attention is paid to this in education and in the professional literature. Much attention is rightly given to the theory of design, however not how to put it in practice. In the book '[Methodical design explained. Insights into the methodical design process as it is applied in companies](#)'. I have explained the overall design process as applied in companies. In this book, the DfM aspect is only tangentially highlighted. However, given its importance, this aspect in the development process is extensively highlighted in this book.

I have written this book to share my many years of experience in this field.

“If you can’t explain it simply, you don’t know it well enough.” – Albert Einstein. I don’t know if this statement comes from Albert, but I like the idea. In the book I have tried to following this rule of thumb.

My thanks go to all the companies where I have had the pleasure of applying methodical design in practice. Due to, the various roles I have fulfilled as; (lead) engineer, group leader, architect, project leader, manager of the R&D department, and value engineer, I was able to get to the core understanding of the design process.

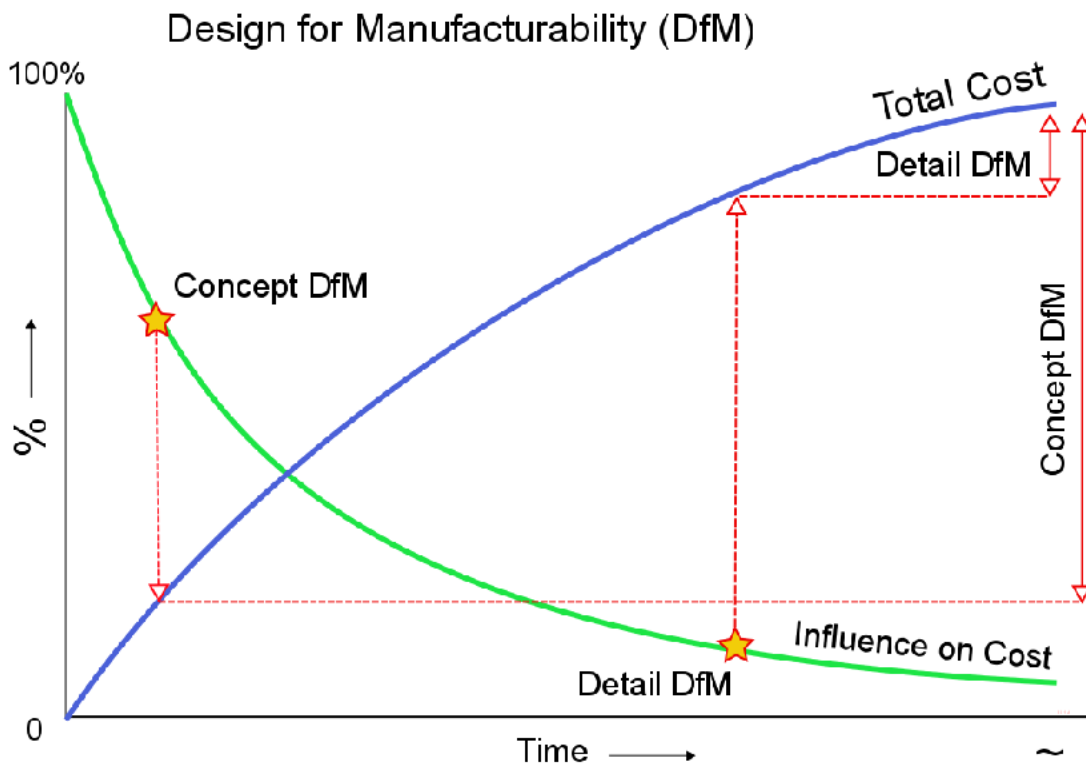
‘Ultimate development and production process.’

*Predicting the future is and remains a perilous undertaking. Extrapolating data from the past and translating it to the future is the most common way to predict the future. It may be that in the future there will be revolutionary discoveries that will make possible processes of development and production that we cannot imagine today. Nature uses the principle of replication. With the principle of "**rapid prototyping**," (Additive manufacturing) it is possible to create any product with a device that is powered with energy, raw materials, and information. The ultimate form of production process is therefore making the product on site.’ ... **‘In essence, the final development and production process is: "Translating the customer's needs directly into a concrete product or service."** ([Reference](#))*

A special thanks goes to Dave Corben. He helped me with the linguistic aspects of the book.

Laurens van Lieshout December 2024.

Scope and content of the book



70% of the product's cost is determined in the concept design stage.

More than 70% of the final cost of the product is determined during the design phase. Engineers have very little leeway for cost reduction once the design has been established. DfM allows us to select a focus area for the design so that product objectives can be achieved. Design for Manufacturing, in particular, helps to simplify designs and reduce production costs, which usually make up the majority of investments for a company.

The design of a factory plays a crucial role in the quality of the final product. A well-designed factory ensures efficient production, minimizes errors, and guarantees consistent product quality. Here are some reasons why factory design is important for product quality, with examples of good and bad designs:

- **Efficient workflow:** A well-designed factory ensures a logical sequence of production processes, allowing products to be manufactured efficiently and without unnecessary steps. As a result, errors and product deviations are minimized.
- **Pollution reduction:** Separating processes (e.g., raw materials from finished products) can prevent cross-contamination or contamination, which is especially important in the food, pharmaceutical, and semiconductor industries.
- **Serviceability and accessibility:** Good accessibility to machinery and equipment ensures that maintenance can be performed easily and quickly, reducing downtime and loss of production.
- **Safety and ergonomics:** Good design takes into account the safety and ergonomics of the worker, reducing the likelihood of errors due to human factors and increasing productivity.

Examples of good designs:

- **Toyota Production System¹:** Toyota's factories are known for their lean manufacturing principles, with the plant layout designed to minimize waste. Workstations are placed in such a way that materials and parts are readily available, leading to a highly efficient production process and high product quality.
- **Tesla Gigafactory²:** Tesla's Gigafactory is designed with automated production lines and an optimized layout that ensures streamlined production of batteries and cars. This design increases the efficiency and quality of the products by minimizing manual intermediate steps.

Examples of bad designs:

- **Boeing 787 Dreamliner Production Line³:** In the first production rounds of the 787 Dreamliner, parts were produced worldwide and assembled at various locations. This dispersed production line led to issues with inconsistency and quality control, resulting in production delays and quality issues.
- **Ford Pinto⁴ in the '70s:** Production of the Ford Pinto was rushed, and the layout of the production line was not optimized for quality control. This led to safety issues with the vehicle, including an increased risk of fire in rear-end collisions.

DfM provides a much-needed edge for engineering companies in today's competitive market. It is easy to overlook DfM due to the lack of information, but research and case studies have shown that the proper application of DfM principles can guarantee excellent results.

This book gives you practical tools to increase the quality of the product and reduce costs. It emphasizes the importance of manufacturability in the design.

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¹ See: https://en.wikipedia.org/wiki/Toyota_Production_System#References

² See: <https://en.wikipedia.org/wiki/Gigafactory#References>

³ See: https://en.wikipedia.org/wiki/Boeing_787_Dreamliner#References

⁴ See: https://en.wikipedia.org/wiki/Ford_Pinto#Notes

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