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LEAN Production – Easy and Comprehensive

A practical guide to lean processes
explained with pictures

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Foreword



The starting point of “Lean Production – simple and comprehensive” was following Roland's presentation on “Visualizing Complex Issues” when we talked about the complexity of implementing Lean Management. For years, we had been driven by the question of how to communicate Lean theory simply and broadly. After all, a comprehensive understanding of Lean is needed at the beginning of every successful Lean change. True to the motto “just do it”, we started to combine our knowledge and skills on that and brought all of our practical experience together. We put the Lean principles into metaphors and illustrated them with pictures. At that moment, the idea for “Lean Production – Simple and Comprehensive” was born. A Lean professor, a Lean practice expert and an illustrator had come together to create an exciting path.

After almost three years with many controversial discussions, harmonious work meetings and many night shifts, we have now finalized the first edition of “Lean Production – Simple and Comprehensive”. The search for the right

metaphors, the logical structure, the most coherent stories and self-speaking images was not always easy and often challenged us. The feedback from many friends and colleagues has always motivated us. We appreciated their advice and their input moved the book forward.

Our goal is to always keep the topics *simple*, using pictures, examples and concrete experiences from many Lean projects to give the reader a vivid idea about Lean. On the other hand, we present Lean *comprehensively* and propose a concrete guide that has been proven in practice. We cover the entire spectrum from waste basics to the most important Lean principles to field-tested Lean methods and Lean change.

We hope to inspire both the Lean beginner and the Lean expert to find new ways to eliminate waste from their processes every day. And we hope you enjoy reading it.



Roman Hänggi



André Fimpel



Roland Siegenthaler

Introduction

What Is Lean Production?



Lean Production means producing without waste and without detours. The goal is to ensure quality, punctuality and productivity as well as to create the conditions for automation and digitalization.

In a Lean ideal process, the customer is the focus and always gets the right product, at the right place, at the right time, in the right quantity and in the right quality. This 5 X Right basic principle, also known as the 5R principle or just-in-time principle, is a central pillar in the Toyota Production System, the origin of Lean Production (Ōno et al. 2013).

Everything that stands in the way of implementing the just-in-time principle is waste in the sense of Lean Production. Several Lean principles and methods exist to eliminate this waste.

To go down this new path, not only is the knowledge of methods and tools important, but a change in thinking and a new corporate culture are necessary. This change is the most difficult step. We want to inspire you with this book to follow the path of Lean transformation.

Isn't Lean Out?



The first thoughts about Lean Production were made in the middle of the last century in the Toyota factories. In the 1990s, Lean became known in our latitudes through several publications (Womack et al. 2007) and a wave of enthusiasm started, which, however, has noticeably decreased in recent years. Over the years, Lean was labeled as old-fashioned and slowly forgotten. From our point of view, Lean Production has unfortunately only been properly understood in a few companies and therefore only been implemented consistently in individual cases over the years.

Quite often, only a few methods from the Lean toolbox are applied selectively, without pursuing an overall goal and vision. A true Lean culture is missing.

But Lean is like buckling up in a car or washing your hands. It may no longer be new, but it has no expiration date. It is and remains important, meaningful and effective. Today more than ever.

Digitalization Brings Lean Back Into Play!



As we will show with some examples, when using the many available technical possibilities, there is a danger that technologies are used to control waste instead of eliminating it. In all the euphoria surrounding digitalization, Lean therefore takes on great strategic importance for every company today more than ever before. Only when processes are free of waste does digitalization take flight.

This motivated us to bring individual Lean fragments back into an overall context, but still package them clearly. The book presents the interrelationships around Lean in its entirety. This will help you to optimize your production comprehensively and to counter the critical voices in the Lean implementation. The success of your measures will be the engine for the Lean culture and lay the foundation for the digitalization (then making sense) in your company.

Lean Also Works Without a Car Factory



By the way: unfortunately, there is still a persistent belief that Lean Production only works in the automotive industry with large production lines and millions of units. The Toyota engineer Taiichi Ohno (Ōno and Bodek 2008) developed the basics in this context, and we have also gained our experience with Lean, especially in production operations, but not only in automotive manufacturing. However, Lean Production just means “to produce without waste”. And this also works in the bakery, on the construction site, in the office or even at home in the kitchen.

Espresso Without Waste

Start by Seeing the Waste



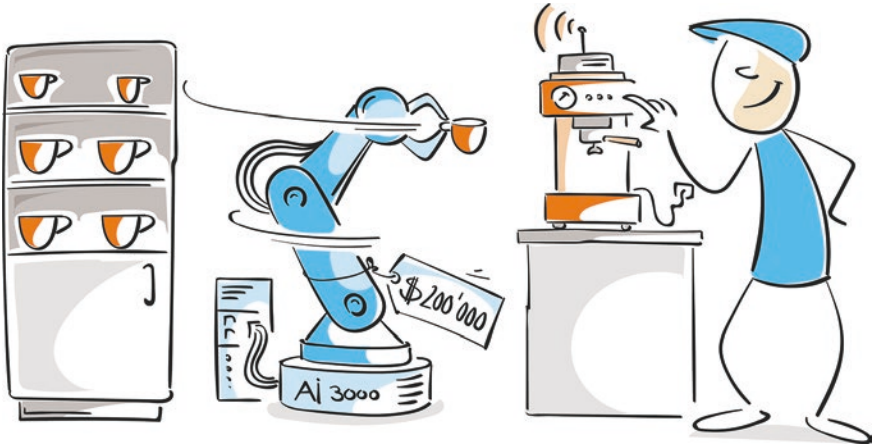
If you examine a process for waste, for example the preparation of espresso, you will be astonished and shocked to discover that the barista spends 45 min per hour waiting and doing other useless things. Only 15 min, or 25% of his capacity, are invested in value creating activities that bring benefits to the customer. If you want to optimize this process, it is not about working faster, but about removing the waste from the process. Making the waste visible and quantifying, it is the first important step on the way to a Lean process.



So where is the waste hiding in the espresso process? To see this, you have to mentally break down the process into small sub-steps: the barista takes the cup (1), carries it to the coffee machine (2), presses start (3), waits until the cup is full (4), and finally the espresso is ready!

First that the barista has to carry the cup the distance from the cupboard to the machine. In the true meaning of Lean, this is waste. Waiting during the coffee making process is also not value creating and therefore waste. So even in this small example, there is quite a bit of waste hidden.

Shortcut Lean through Digitalization?



No matter what kind of waste is currently plaguing us in the production, digitalization seems to be the elegant solution for everything today! But even if you buy the most modern connected robot that autonomously carries your cup from the cupboard to the coffee machine, the waste is still there. Now automated.

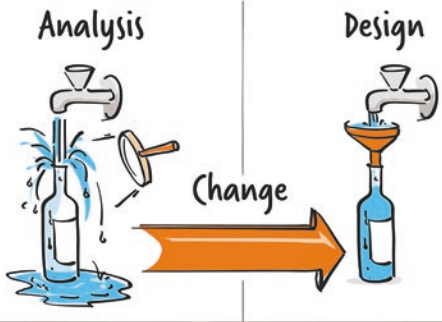


The Way to Lean Produced Espresso



“Don't digitize your mess!” is therefore the top motto. Anyway, it is much cheaper to push the cupboard to the machine anyway than to buy and program a robot. And that is the only way to really eliminate waste.

This is what Lean is all about: seeing waste and systematically eliminating it from your process.

Understanding Lean in Five Steps

| | | |
|---|---|----------------------|
| |  | |
|  | Basis | The 7 types of waste |
|  | Methods | Eliminate waste |

Lean theory is only simple at first glance. Our experience shows that there is a lot of confusion regarding fundamentals, terminology and content. Our structure of the book will remedy this.

After this introduction, the first topic is theory: understanding waste and how to avoid it.

Chap. 1 – The 7 Types of Waste:

Lean Production is waste-free production. So first you need to know what waste is and what types of it there are.

Chap. 2 – The 9 Principles to Avoid Waste:

To eliminate waste and its causes, you need to align your processes with Lean principles. We present the nine most important ones.

Now it is getting practical: Chaps. 3 and 4 deal with concrete methods and tools to see the waste and design your production according to the Lean principles.

Chap. 3 – Methods to See Waste:

Here we show you methods to see and quantify waste in your production.

Chap. 4 – Methods to Eliminate Waste:

Now that you can see waste in your processes, you need to eliminate it. We will show you the most important methods from the Lean toolbox that you can use to implement the 9 principles and thus sustainably banish the 7 types of waste from your processes.

Finally, we discuss approaches to implementing the change to a Lean company.

Chap. 5 – Lean Change:

To become a Lean company, it is unfortunately not enough to apply some methods selectively. Lean only works if it is properly anchored in the company. Lean change requires a comprehensive cultural change. This must be carefully considered and implemented. We show how it can succeed.

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About the Authors



Roman Hänggi Professor of Production Management

After studying engineering and earning a doctorate in economics, Roman started in industry in the early 1990s, optimizing an optics manufacturing facility at Leica with Lean. This enthusiasm for Lean has accompanied him throughout his professional life. He implemented further successful Lean projects in production at Bosch, Hilti and Arbonia and used this experience from production to also optimize processes in development, service or administration with Lean. Curiosity and the desire to pass on his extensive knowledge from industry led him to the Chair of Production Management at the University of Applied Sciences OST. There he motivates students in Rapperswil and St. Gallen in lectures on Lean and digitalization in industry. Practice is important to him. That is why he supports industrial companies

on their way to becoming Lean champions and Industry 4.0 winners. He also teaches as a lecturer in executive programs at the University of St. Gallen. In his free time, Roman can be found on the ski slopes in Appenzell (Switzerland).



André Fimpel Lean Manager & Lean Consultant

Lean is a question of culture. In addition, when it comes to culture, André has a broad horizon. Born in Brazil and raised in Germany and Argentina, he knows all facets of people's ways of living and working. After graduating as an industrial engineer, he started his mission Lean as a consultant 15 years ago: first for the Fraunhofer Institute for Manufacturing Engineering and Automation in Stuttgart, then for Porsche Consulting and now for Hermes Schleifmittel GmbH. However, consultant is probably the wrong name for his vocation. He is a Lean enthusiast, a tinkerer and a communicator who manages to get both the mechanic at the Chinese car plant and the CEO of the Italian shoe factory excited about Lean Production. André is the most tolerant person on earth, except for one thing he hates with all his heart: inventories and the six other types of waste.

**Roland Siegenthaler** **Illustrator for knowledge and processes**

Roland is extremely curious, extremely creative and extremely comfortable. These three characteristics have qualified him for the post of questioner, draftsman and text seasoner in this book. Actually, Roland is an electrical engineer. At the age of 30, however, he realized that projects rarely fail because of technology, but mostly because of communication. As an autodidact, he has therefore developed into a visualization professional over the years. With his explanatory skills, he now supports teams, from production to management, in communicating innovation and change. His clientele ranges from small businesses to large international corporations. Roland's audience also includes his three funny children, to whom he tries to explain this fascinating and crazy world with pictures.

Abbreviations

| | |
|------------------|--|
| 5S | Lean method, which organizes the workplace with the five steps of sorting, cleaning, making visible, standardizing and (ab)securing the standard |
| 5R | 5X-Right basic principle or also just-in-time principle. Means ensuring the right part, in the right quality, at the right time, in the right place, in the right quantity |
| A3 | Method of structuring the problem solution on an A3 sheet of paper |
| ABC–XYZ Analysis | Classification of parts according to part price for purchased parts or manufacturing costs for in-house production (ABC classification) and consumption (XYZ classification) |
| Andon | Method from the Toyota production system for immediate visualization of process problems, e.g., using a signal lamp |
| BOM | Bill of Material, the structure or tree of a product, list of material of assemblies, subassemblies and single parts of a product, often the term parts list is being used |
| Clock | Time in which a process is repeated |
| C-Parts | Low value materials (such as small parts, e.g., screws, nuts) |
| CT | Cycle time, time between completion of two products, time a part takes to go through a process |
| ERP | Enterprise resource planning, IT system for planning and controlling the flow of goods and values within a company. |

xxiv Abbreviations

| | |
|------------------------|---|
| FIFO | First-in-first-out, parts produced or stored first are removed first |
| Gemba | Japanese, “the real place”. In the Lean context, this is the place where value creation happens |
| Handling Step | Processes such as transporting, testing, unpacking, storing or even transferring are handling steps and waste |
| Handling Step Analysis | The handling step analysis presents the handling steps for a process in context and helps to see the waste |
| Industry 4.0 | Use of digital technologies to increase productivity in an industrial company, especially in production |
| Jidoka | Intelligent mechanical solutions to avoid errors, path to full automation |
| JIS | Just-in-sequence, external delivery in sequence |
| JIT | Just-in-time, direct delivery between processes without warehouse and intermediate buffer |
| Kaizen | Management approach to continuous improvement |
| Kanban | Methods for pull control, based on a signal(=Kanban) for replenishment control |
| KPI | Key performance indicator, measure of key performance parameter in the company |
| LS, lot size | Related production or procurement of parts |
| Lead Time | Time a part takes to go through one or multiple operation processes |
| Milkrun | Clocked route trains to supply production at specified intervals |
| MRP | Material requirement planning, term for planning and control via BOM explosion and inventory reconciliation. |
| MRPII | MRP including capacity planning |
| MTM | Methods–time–measurement, method for time evaluation based on time modules with standardized and defined specifications |
| Muda | Japanese term for waste |
| OBC | Operator balance chart, diagram for visualization of work distribution |
| OEE | Overall equipment effectiveness, method for measuring the effectiveness of equipment or processes. |
| Pareto rule | 80–20 rule means 20% of causes/issues cause 80% of problems/results |
| PDCA | Approach from quality management for continuous problem solving in four phases (“plan”–“do”–“check”–“act”) |