Preface to the 1st English Edition

In recent years, the Logistic Operations Curves Theory has raised increasing attention in the international scientific community of operations management. This has encouraged us to present an English translation of the second German edition. The Logistic Operations Curves Theory continues to be developed and will be further expanded.

Our sincere thanks is addressed to Daniel Berkholz, a research engineer at the Institute of Production Systems and Logistics (IFA), Leibniz University of Hannover, as well as the translator Rett Rossi for their enthusiasm and never ending efforts to help us find a sound, scientific path through the jungle of new variables and terms not used in traditional literature.

We wish our readers a fruitful discourse with our ideas and look forward to receiving any feedback you may have.

Garbsen, December 2007
Peter Nyhuis
Hans-Peter Wiendahl

Preface to the 2nd German Edition

The first edition of this book was met with very positive resonance. Numerous questions and suggestions provided an incentive for us to continue working on the *Logistic Operating Curves (LOC)* and to let the new results flow into this second edition.

The range of validity for the Logistic Operating Curves Theory has been extended by Schneider, who developed the *Manufacturing System Operating Curve (MSOC)*. The MSOC makes it possible to establish Logistic Operating Curves for manufacturing areas with randomly networked workstations.

The *Schedule Reliability Operating Curves (SROC)* developed by Yu are a completely new approach. Yu has succeeded in deriving an approximation equation for describing the schedule reliability of a workstation.

The *Storage Operating Curves (SOC)* were expanded by Lutz to include the so-called *Service Level Operating Curves (SLOC)*. Based on them and in analogy to the Bottleneck Oriented Logistic Analysis for production areas the *Logistic Storage Analysis* was developed. Quantifying the logistic potential in a storage area and identifying the measures necessary for exploiting it are essential elements of this method of analysis.

By linking the Bottleneck Oriented Logistic Analysis with the Logistic Storage Analysis the logistic interactions within a supply chain can also be understood. The potential can be determined with regards to the service and stock levels including over a number of value adding stages. Moreover, these can be aggregated and expressed as a total potential. Thus, there is now a fundamental and consistent analysis method available for quantifying the inherent relations between the logistic objectives in production systems, in the different storage stages, and in the entire supply chain.

We would like to express our heartfelt appreciation to Stefan Lutz, Michael Schneider and Kwok-Wai Yu for their support in developing the new sections.

To all of our readers, including both those who work in research as well as practitioners, we hope to provide continued inspiration and practical support in overcoming their logistic problems. We welcome the chance to receive your constructive criticism, suggestions and any experiences you may have in applying the Logistic Operating Curves Theory.

Hannover/Munich, Summer 2002   Peter Nyhuis
                                                    Hans-Peter Wiendahl

Preface to the 1st German Edition

For many production enterprises, the possibility of distinguishing themselves from their competitors is frequently possible due to a shorter delivery time and higher delivery reliability. This requires firmly controlling the internal throughput times and schedule adherence. At the same time cost relevant goals such as stable and high utilization as well as low stock levels in the raw material, semi-finished and finished goods stores cannot be forgotten. Solving this well known dilemma of operations planning is the object of countless efforts from researchers and practitioners alike. In the 1960s, great hope was set in the methods of Operations Research, in particular in queuing theory. However, due to the complex boundary conditions of job shop and series production, queuing theory was unable to establish itself. Even simulations did not provide the hoped for breakthrough due to the large amount of effort required especially for a company's already running operations.

The Funnel Model and the Throughput Diagram that is derived from it, developed by Prof. Hans Kettner and his assistants at the Institute of Production Systems and Logistics, Leibniz University of Hannover in the 1970s was thus met with great interest. In particular, it attracted attention because the logistic objectives throughput time, WIP, utilization and schedule reliability could for the first time be presented visually and conclusively. The Load Oriented Order Release method that arose from there and the further developed Load Oriented Manufacturing Controls were widely accepted in job shop production.

The Logistic Operating Curves (LOC), developed later within the context of simulation analyses, quantitatively described the impact of the WIP on the utilization and throughput time also for the first time. Due to the huge efforts required for the underlying simulations, the LOC were impractical and therefore limited to theoretical applications.

It was Nyhuis' habilitation in the early 1990s that initially made it possible to simply calculate the Logistic Operating Curves based on the combination of an ideal manufacturing process model suggested by von Wedemeyer with experimental and empirical supported analyses. Consequently in the years following, an extensive field of application opened up both in research and on the production floor.

For the first time, the models of the Logistic Operating Curves for production and storage processes are comprehensively described in this book. In addition, the necessary formulas are derived step by step, and a comparatively simple computational scheme using data that is standard in manufacturing and storage controls is developed from there. Thorough tests with field data and extensive simulations prove how the individual equation parameters influence the order and capacity structures. Thus making it possible to estimate the accuracy of the information even when the original data is inaccurate or contains errors – as is frequently the case on the shop floor. Through a comparison with queuing theory and simulations, both the advantages and the limitations of Logistic Operating Curves are clearly identified.

The usefulness of the Logistic Operating Curves is evident in numerous theoretical and application based projects conducted by the Institute of Production Systems and Logistics. Currently the Logistic Operating Curves are mainly applied: in dimensioning WIP buffers and WIP areas when planning factories; conducting a Logistic Positioning for manufacturing areas and stock levels with respect to the throughput time, utilization and WIP; in production control in order to continually improve the logistic objectives; in parametrizing lot size determination, throughput scheduling, and order release in PPC systems as well as in Bottleneck Oriented Logistic Analyses for developing the hidden logistic potential of the throughput time and WIP. Further foreseeable application possibilities include guiding construction and development areas, extending the Logistic Operating Curves to include schedule reliability, cost-wise evaluating production processes with different WIP situations and evaluating supply chains beyond the manufacturer's borders.

This book is based on a large amount of theoretical and empirical work at the Institute of Production Systems and Logistics, some of which goes back twenty or

more years. Most notable here are the dissertations from Bechte, Dombrowski, Dräger Erdlenbruch, Fastabend, Gläßner, Lorenz, Ludwig, Möller, Penz, Petermann, Scholtissek, Springer and Ullmann. Each of which have focused on various aspects of modeling, planning, and controlling production based on Throughput Diagrams and Logistic Operating Curves. Every one of the authors has thus contributed to the Logistic Operating Curves Theory.

We would like to wish all of our readers, including both those who work in research as well as in the industry, inspiration and practical use in overcoming their logistic problems. Furthermore, we would be grateful for constructive criticism, suggestions and experiences in applying the Logistic Operating Curves Theory.

Hannover, Summer 1999   Peter Nyhuis
                                                                   Hans-Peter Wiendahl

Translator's Notes

Translating the Fundamentals of Production Logistics has provided a unique and extremely pleasurable challenge – one that I hope we have successfully met. Seeing that the theory, tools and applications presented here have only been partially exposed to an English language audience, the terminology for discussing them has up to now not fully existed. This of course is often the case when introducing new concepts. However, Prof. Dr. Nyhuis and Prof. Dr. Wiendahl also had a goal in mind when choosing these terms: They wanted to target an as broad as possible international audience who are interested in logistics and curious about what approaches to a logistic theory are being made elsewhere. What this meant for the translation was trying to find clear, self-explanatory terms and implementing them consistently. We hope that we have managed to achieve this. Nonetheless, just as the authors hope to hear from readers with regards to their experiences and thoughts I too hope that you will also let the authors know if mistakes or areas lacking clarity are found. After all, this edition of the Fundamentals of Production Logistics is meant to initiate discussion and is therefore hopefully just a beginning.

As this is a translation of the German edition and not a new English edition, the majority of bibliographical references are also German. Those that are in English have been marked with an asterisk e. g. [Wien-95a*], in order to be easily identified.

Berlin, December 2007   Rett Rossi