Preface

Over the last decades, logistics and supply chain management (SCM) have become one of the most often and intensively discussed fields in management and economics. Although many ideas and concepts used in logistics and SCM are reasonably old, much effort has been undertaken to transfer them into practice and to improve them further. Many publications, in academia as well as in application-oriented literature, have appeared. Logistics and SCM have become fields which are rich in terms of innovation and progress.

Despite these promising developments, there are still obstacles to bring advanced visions of improved planning and cooperation along logistics processes and supply chains into reality. On the one hand, there are many practical issues such as the availability and transparent processing of information, difficulties in establishing cooperation, or because of an increasingly uncertain or rapidly changing planning environment. On the other hand, it has become more and more apparent that the underlying planning problems are very complex and hard to solve even in the case that respective data is fully retrievable and complete.

From a computational point of view, many of these problems can be characterized as NP-hard, which means that the number of possible solutions is increasing exponentially with the problem size and that presumably no algorithms exist, which can solve them exactly within acceptable time limits—at least when the problems are “rather large.” Unfortunately, most real-world problems can be considered rather large.

Especially during the last 20 years, these problems have been investigated intensively in the academic literature, and many suitable solution approaches have been suggested. As the problems usually cannot be solved exactly within an acceptable time, these methods allow to find sufficiently good, although not necessarily, optimal solutions.

One of the still growing streams of methods belongs to the field of computational intelligence (CI), which comprises mostly approaches inspired by concepts found in nature, e.g., the natural evolution or the behavior of swarms. These methods are based on general heuristic ideas and concepts for problem solving, which
can—with some adaptations—be applied to a wide range of problems. To distinguish these methods from simple heuristics, which are often very specific to a single type of problem, they are also denoted as metaheuristics.

Although the respective computational intelligence methods have been studied in numerous applications related to logistics and supply chain management, they are hardly discussed in general textbooks in these fields. Often, the treatment of formal planning problems in these books does not go much beyond some rather simple and general results, which are often not applicable in real-world settings, for instance, the more than 100-year-old equation for calculating economic order quantities.

The book is intended to reduce this gap between general textbooks in logistics and supply chain management and recent research in formal planning problems and respective algorithms. It focuses on approaches from the area of computational intelligence and other metaheuristics for solving the complex operational and strategic problems in these fields.

Thus, the book is intended for readers who want to proceed from introductory texts about logistics and supply chain management to the scientific literature, which deals with the usage of advanced methods. For doing so, state-of-the-art descriptions of the corresponding problems and suitable methods for solving them are provided. The book mainly addresses students and practitioners as potential readers. It can be used as additional reference for undergraduate courses in logistics, supply chain management, operations research, or computational intelligence or as a main teaching reference for a corresponding postgraduate level course. Practitioners may read the book to become familiar with advanced methods that may be used in their area of work. For a reader, a basic understanding of mathematical notation and algebra is suggested as well as introductory knowledge on operations research (e.g., on the simplex algorithm or graphs).

The book is organized as follows: The first two chapters provide general introductions to logistics and supply chain management on the one hand and to computational intelligence on the other hand. The subsequent chapters cover specific fields in logistics and supply chain management, work out the most relevant problems found in those fields, and discuss approaches for solving them. In Chap. 3, problems in transportation planning such as different types of vehicle routing problems are considered. Chapter 4 discusses problems in the field of production and inventory management. Chapter 5 considers planning activities on a finer level of granularity, which is usually denoted as scheduling. While Chaps. 3 to 5 rather discuss planning problems, which appear on an operative level, Chap. 6 discusses the strategic problems with respect to the design of a supply chain or network. The final chapter provides an overview of academic and commercial software and information systems for the discussed applications.

We hope to provide the readers a comprehensive overview with specific details about using computational intelligence in logistics and supply chain management.
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