How to Choose an Order-Picking System

Marita Ellinger – Technische Universität Dortmund

Tim Geißen – Fraunhofer Institut für Materialfluss und Logistik, Dortmund

Detlef Spee – Fraunhofer Institut für Materialfluss und Logistik, Dortmund

It turns out that supply chains are subject of increasingly rapid changes. This is caused by constant changes in customer requirements, by changing the product line or by changing the production structure. This change can be slowly progressive (purchase behavior of customers, changes to individual products in a wide range of products) or due to selective changes occurring (new products in a narrower range of products, production shift). Distribution Center as a hub node in the supply chain are strongly affected by these changes. To maintain the efficiency of intra-logistics, as is attempted robust systems to prevent the negative impact on efficiency. If the degree of change continue to accelerate, more frequent changes in intra-logistics systems are required. The decision as to whether a modification is appropriate, can often only be done by comparing the existing system with that of the modified structures matching system. This review by a planning process that examines the entire system for suitability is often not performed because spared the effort necessary, and the necessary resources are not available. Thus, curing the symptoms, although a change of the entire system would be far more economical.

To remedy this situation, it would be necessary to accelerate the planning process dramatically – possibly up to an automatic monitoring system, which gives an early indication of the controlling necessary changes. For such services are possible, the intra-logistics planning, ideally, take place automatically. To make this possible far-reaching systematizations of the planning process are required. The necessity for this has already been recognized by some research institutions.

The approach to the automatic planning requires an appropriate ontology, since such a system on the one hand by the scope of work requires a broad participation of researchers, on the other hand, it must itself changeable, and above all be expandable, so it's possible to integrate future technological developments into the system.

An important functional area in intralogistics systems is the picking area - especially because of its relevance for the cost of logistics. The importance of the costs generated by order picking in distribution centers shows FRAZELLE by illustrating the distribution of operating costs in typical warehouse and goods distribution systems. (cf. [FRA02], p 148)

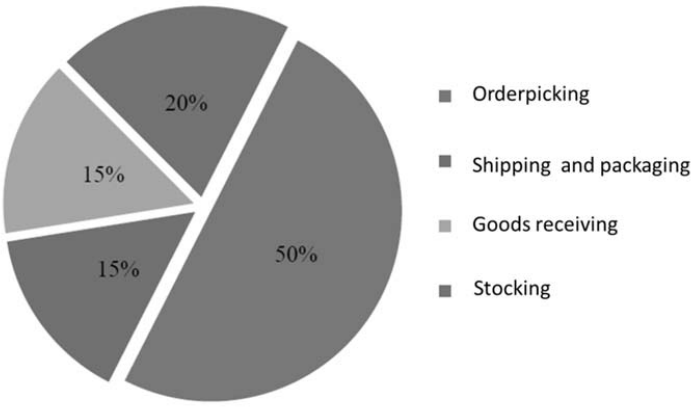


Fig. 1: costs in a warehouse [FRA2]

The costs referred to in FRAZELLE Figure 1 shows that half of the cost is divided between the three areas of dispatch, receipt and storage. The other half is arises in the picking area (see [FRA02], p 147 f). A different point of view of cost causation by order picking shows NAVE. He breaks down the costs in terms of sales, noting that the costs, caused in the picking area, can be up to five percent of sales, depending on the industry and characteristic (see [NAV09], p.17). This underlines the importance of the picking for the overall success of a company.

At the same time, order picking the most complex subsection in intra-logistics. It is subject to a large number of design-related factors and others are very many possible implementation alternatives. In addition, there has been no closed approach that leads to an optimal coherent system.

One way to solve this challenge is an approach of "rapid engineering." This allows you to compare many system variants in a short time, by comparing to competing alternatives, or iterative analysis. The focus is given to the concept plan, as this is the first step in the planning phase.

This new approach to the structuring of picking VENN and GEISSEN developed (cf. [VG11]). With the new structure, the goal is pursued to simplify the planning process of order-picking and making it more transparent. The systematization is applied to systems that have "in today's design projects a real chance of being realized" ([VG11], p 338) and includes manual to semi-automated systems (see [VG11], p 338). These block types are defined and characterized.

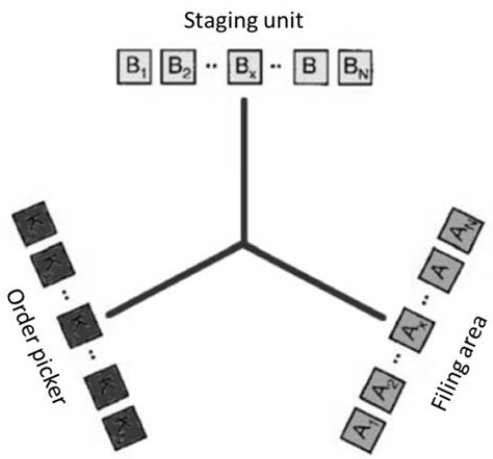
The next task is the development of mapping diagrams. With their help, within the framework of Planning the selection of standard orderpicking systems will be enabled.

The key decision factors for selecting a picking must become identified and based on these decision rules for the choice of picking have to be created. On this basis, appropriate decision-charts will be developed.

Structure to find

Every order picking system consists of these three elements:

- Staging units
- Order-picker
- Filing area



The possible configurations (the way these three elements are arranged towards each other) result in order picking principles.

A total of eight different order picking principles have been distinguished, which are called block types. In line with the system versions of Gudehus is the interaction between providing unit, order pickers and filing area the differentiator (see [GUD05], pp. 694).

The block types are used for pre-selection of an order picking system in the planning process. Here, the preselecting based on the suitability of the preferred areas and areas of application of the block types. During the planning stage, the block types have to be further developed, so that results from the actual selection of materials handling, storage and picking a specific module. Using this structure can be a structured, multilevel planning projects implemented in the first type, following the last block and the design options are set (see [VG 11], p. 338 et seq .) The relationships between the concepts of block type, block and zone are illustrated in the next figure.

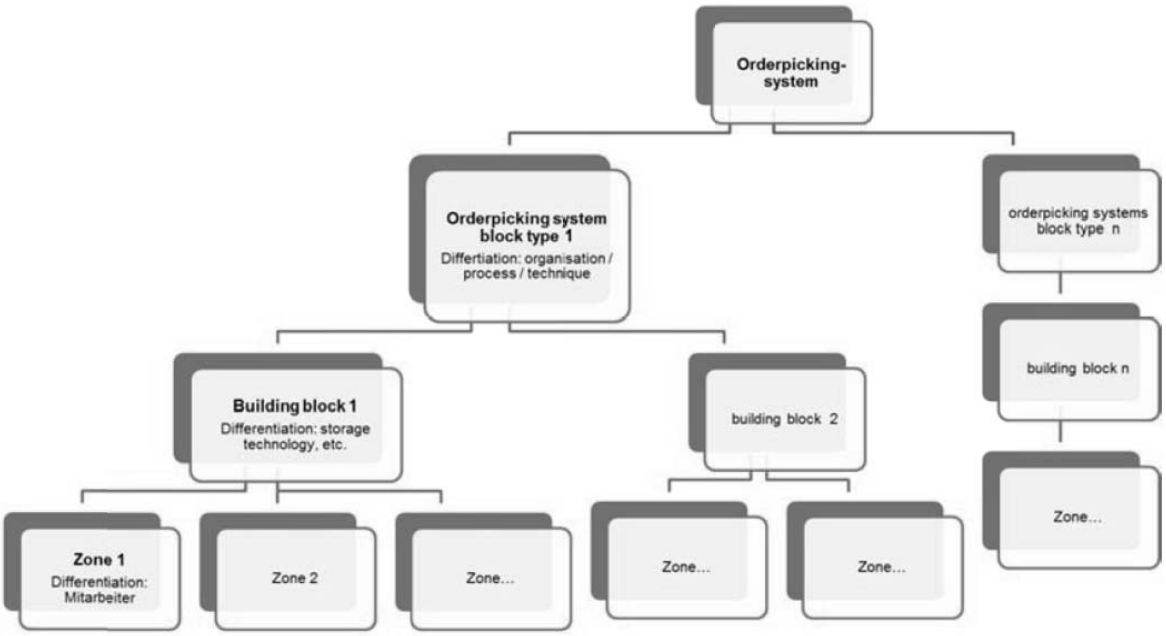


Fig. 3: Relationship between block type, block and zone

An order picking system consists of one or more block types. These again can become differentiated into components which can be divided into zones. The key words for the understanding of these order picking systems concepts are defined as follows:

Block type
A block type is a (partial) realization of the form of a manual part of an order picking system. A total of eight different block types, that can be differentiated by the interaction of filing area, supply and order pickers, have been found. An example of a block type is a goods-to-man piking area.

block
A block is an instance of the block type. It represents a concrete expression of the form of block type and is essentially specified by the used storage, handling and transport-/conveying technique. An example is in relation to the block type "goods-to-people" one of the associated building blocks called, could consist of a miniload system with automatic storage and retrieval machines and a pick by light communication system.

Zone
When zones are organizational segmented (defined work areas) with in a block. They are characterized by the same technology and organization. The distinguishing feature is its people. Often, the zone picking is implemented by a handoff principle, but the zones can also be configured in series or in parallel.

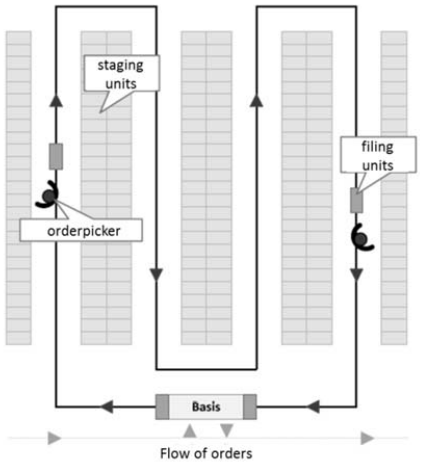
Provision of Article
The article provision may be made order related or non-order related. Order related means that articles are provided for picking (or to the order batch) belonging to the article. In order to deploy a non-order related staging unit, it is independent from the current labor reservoir. The order-picker are generally moving to the articles.

Filing unit
The provision of the order shelves can be done manually or automatically.

Block types

Following the eight block types are explained. The illustrative figures are following a strict structure. The staging units are colored in yellow in all figures. The order and the shelves are marked in green, the path of the order-picker is marked with red arrows.

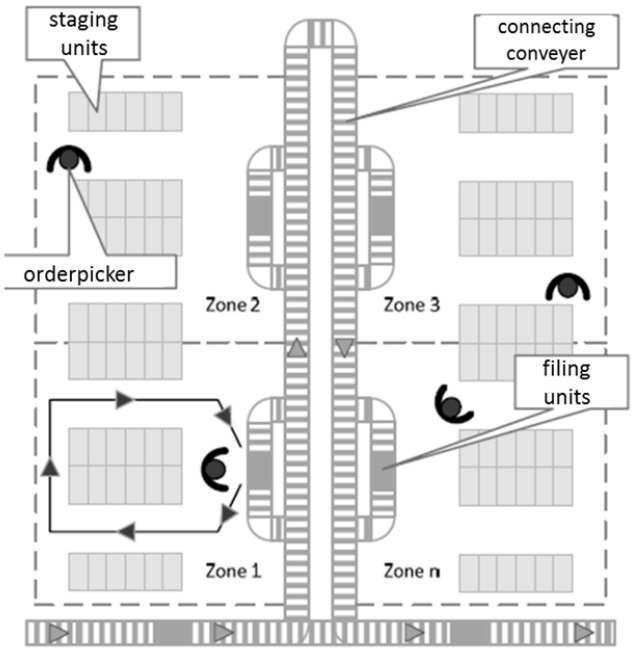
Block type 1: order picking with static supply of staging units



The order-picking with a neutral article provision is the simplest and most commonly encountered

picking-system. This procedure corresponds to the well-known men-to-goods principle. The supply units are statically realized e.g. in pallet racks, shelves or flow racks. The picker moves with the order load carriers through the isles to the supply units and removes the article. After completion of order-picking process, it moves with the order load carrier to a base station. He drops it and receives from her new order load carrier (see [VG11], p 339; [GEI10], p 83; [VEN10], p.63).
To support the order-picker, order-picking-carts, storage and retrieval devices or automated guided vehicles (AGVs) can be used. Optimization opportunities involve the performance and the distances and are made possible by route optimization, route optimized presentation of articles and multi-order picking. With the help of the route optimization, the average route distance the order-picker when processing a customer order, will become minimized.

block type 2: Zone-picking with static supply of staging units

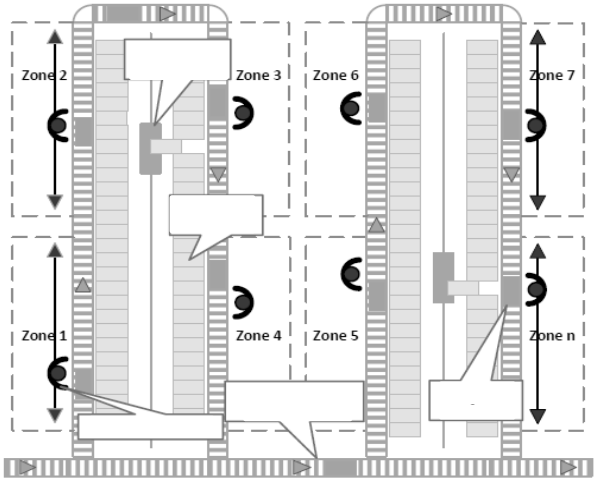


Also in block type 2 is the basic principle of picking is the "men to goods" principle. The supply units are stored in shelves, flow racks, on pallet racks or on the floor. The picker doesn't move through the entire warehouse, but in decentralized picking zones. The order trays are transported via conveyor system or by means of automated material handling equipment in each zone. In the zones, the respective order items can be picked. Within the zones is normally dealt with only a partial order, so the order load carrier will be processed e.g. by a collection and sorting system. Often this block type is implemented with a bucket brigade principle.

block type 3: zone-picking with dynamic supply of staging units

This component type represents a hybrid of men to goods and goods to men picking principle. The staging units are provided order-related by the goods to man principle

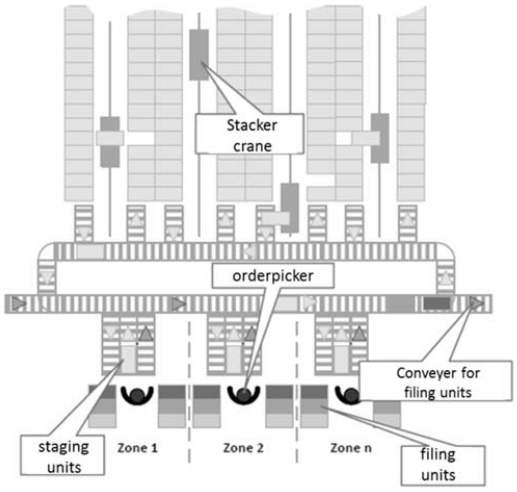
(at least partly order-related). The provision is made on the long side of the high-bay or miniload storage and done as well as the replenishment by storage and retrieval devices. The pickers typically move into areas and remove the items along the aisle of the staging units. The articles are stored in order shelves, which are usually transported by a connected conveyor system.



A characteristic feature of this block type is that the staging units will not be stored after unloading mandatory, but more frequently needed items remain at the staging areas. Alternatively, this block type without handling and zoning can be implemented. To optimize the picking, the shelve locations can be provided with pick-by-light displays and the filing application may be a shipping container so that the principle of picking and packing can be realized

block type 4: workstation based order picking with dynamic supply of staging units and manual supply of load carriers

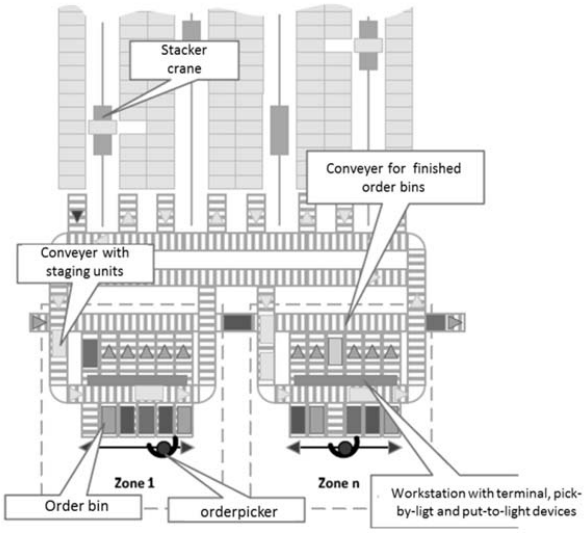
A classic goods to men picking is represented by block type 4. The staging units are transported from the warehouse to the pre-store area and there presented for picking Here, the pickers are in permanent jobs. They have to cover any major routes. Therefore, this type is referred to as stationary. Each workstation, where the order-picker picks the items is corresponding to a zone.



Depending on the organization of picking the item be removed for an order and put in an order filing
(single order processing) or extracted for several jobs and several shelves distributed order (single-stage serial processing). The order trays are manually placed at the workstations available and

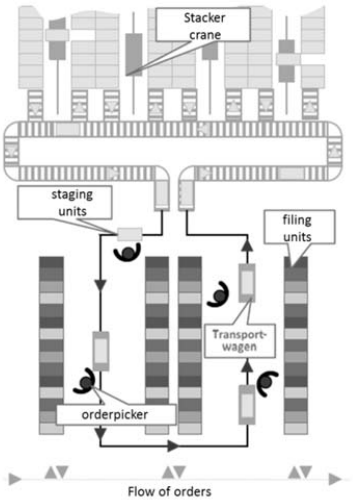
can be transported manually or via a conveyor to the packaging and shipping area. Unlike block type 3, in this block type the article load carrier are stored in the staging units remaining amounts, or put another again picking work available. The workstations of the pickers are usually equipped with stationary terminals. In addition, put-to-light systems support the filing of items in the order container.

block type 5: workstation-based order picking with dynamic supply of staging units and automated supply of order located carriers



This is the realization of the form of goods to men principle. The staging units are removed from stock and transported to the workstations. The pickers work at fixed stations and distribute those items taken from the staging units, several order carriers. Each job corresponds to a zone. The order trays are automatically transported to the workstation and after picking automatically transported to the next area. The picking is typically supported by pick-by-light and put-to-light systems. To communicate with the Warehouse Management System (WMS) and the commissioner, a terminal is used. In between zones due to the complex control usually no forwarding of the order carriers – with the principle of bucket brigades - takes place.

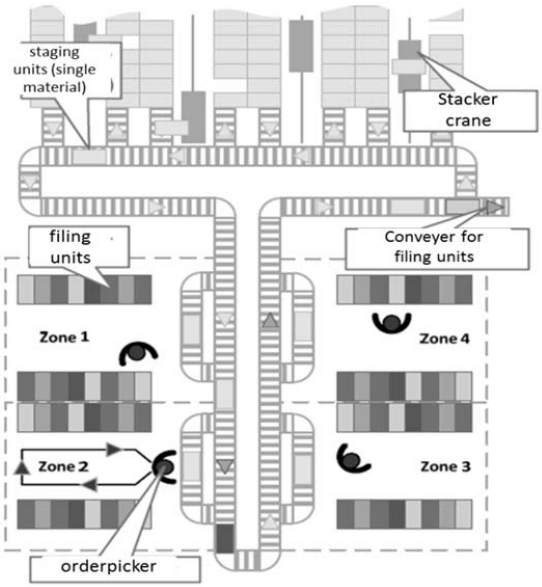
block type 6: Inverse order picking with manual supply of order load carriers



Block type 6 is the reverse of the well-known principle of type 1. The picker does not move with the order load carriers to the staging units, but vice versa. Formative for inverse process is the movement of the picker to the order bins. The staging units are removed from the storage and transported to a workstation. The picker takes the staging unit and moves with it to the order carriers and puts the items into these. The order carriers are static on the ground or on a shelf. Typically, batches will be processed. Remaining quantities are either used in the batch or stored. Applications for this block type in e-commerce and store delivery (see. [VG11], p 339; [GEI10], pp. 86 f; [VEN10], pp. 65 f; [tHSB11], pp. 89 f).

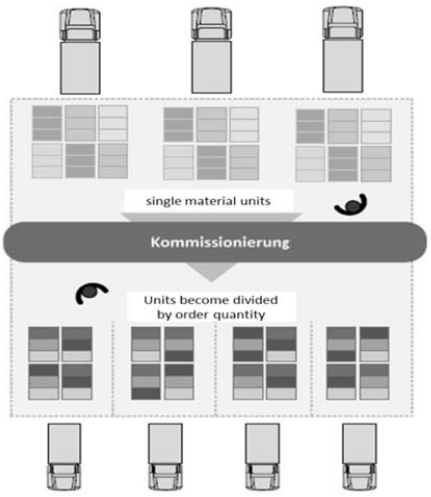
block type 7: Inverse Zonen-picking with manual supply of load carriers

Block type 7 also inverts the allocation of staging units and order load carriers and is thus an inverse method. This type is the counterpart to second block type.The staging units come from the storage and are transported via a conveyor system to the individual zones, in which the order-picker distributes the items into the order load carriers.



Then, the remaining amounts in the staging units will be transported to the next zone or to the warehouse. Depending on the organization, the order load carriers can become transported into the packaging or shipping area by conveyors (see [VG11], S. 339 f.; [GEI10], S. 87 f.).

block type 8: two stage cross-docking with depalletizing and sorting



block type 8 is a special case of picking, but it completes the developed systematization.

In this type of articles shall be delivered cargo units and converted by an order-picking process in order-based dispatch units. Contrary to the usual picking here is not instead of taking staging units, but the loading units are broken up and repackaged without rest. The application is the equitable distribution of store delivery in the wholesale business.

References

[ADA96] Adam, Dietrich:
Planung und Entscheidung - Modelle, Ziele, Methoden.
4. Auflage, Wiesbaden: Gabler, 1996.

[ARN08] Arnold, D.:
Innerbetriebliche Logistiksysteme.
In: Arnold, Dieter (Hrsg.); Isermann, Heinz (Hrsg.); Kuhn, Axel (Hrsg.) et al.:
Handbuch Logistik.
3. Auflage, Berlin/Heidelberg: Springer, 2008, S. 18-21.

[DUL05] Dullinger, Karl-Heinz:
Quo Vadis - Material Handling Band 1.
Mönchengladbach: Karten Druck und Verlag Gmbh, 2005.

[ELL09] Ellinger, Marita:
Strukturierte Vorgehensweise bei der Auswahl von Kommissioniersystemen.
Diplomarbeit, Technische Universität Ilmenau, 2009.

[FRA02] Frazelle, Edward:
World-class warehousing and material handling.
New York/Chicago/San Fransico: McGraw-Hill, 2002.

[GEI10] Geißen, Tim:
Bewertung von Entscheidungskriterien zur Auswahl von Kommissioniersystemen.
Diplomarbeit, Technische Universität Dortmund, 2010.

[GUD05] Gudehus, Timm:
Grundlagen, Strategien, Anwendungen.
Berlin/Heidelberg/New York: Springer, 2005.

[GUD08] Gudehus, Timm:
Kommissioniersysteme.
In: Arnold, Dieter (Hrsg.); Isermann, Heinz (Hrsg.); Kuhn, Axel (Hrsg.) et al.:
Handbuch Logistik.
3. Auflage, Berlin/Heidelberg: Springer, 2008, S. 668-681.

[GUD73] Gudehus, Timm:
Grundlagen der Kommissioniertechnik - Dynamik der Warenverteil- und Lagersysteme.
Essen: W. Girardet, 1973.

[HB85] Hentze, Joachim; Brose, Peter:
Unternehmensplanung - Eine Einführung.
Bern/Stuttgart: Verlag Paul Haupt, 1985.

[JPP+89] Jünemann, Reinhardt (Hrsg.); Pfohl, Hans-Christian (Hrsg.); Piepel, Ulrich et al.:
Materialfluß und Logistik - Systematische Grundlagen mit Praxisbeispielen.
Berlin/Heidelberg/New York: Springer, 1989.

[MG08]
McGinnis, Leon; Goetschalckx, Marc: The warehouse Design Workflow Model, IMHRC 2008

[NAV09] Nave, Markus:
Einführung und Grundlagen.
In: Pulverich, Michael (Hrsg.); Schietinger, Jörg (Hrsg.):
Handbuch Kommissionierung - Effizient picken und packen.
München: Heinrich Vogel, 2009, S. 16-29.

[PIE82] Pieper, Rudolf:
Entwicklung von Entscheidungshilfen zur Auswahl und Bewertung von Kommissioniersystemen.
Dissertation, Technische Hochschule Aachen, 1982.

[POT94] Potyka, Sebastian:
Systematik zur Selektion von Kommissioniersystemen in der Planung.
Dissertation, Universität Dortmund, 1994.

[SAD07] Sadowsky, Volker:
Beitrag zur analytischen Leistungsermittlung von Kommissioniersystemen.
Dissertation, Universität Dortmund, 2007.

[SCH03] Schulte, Joachim:
Gestaltung von Kommissioniersystemen 1 - Einflüsse neuer Logistikstrategien.
In: Hebezeuge und Fördermittel 43, 2003 (6), S. 3-5.

[SPE09] Spee, Detlef:
Systematik der Kommissioniersysteme.
In: Pulverich, Michael (Hrsg.); Schietinger, Jörg (Hrsg.):
Handbuch Kommissionierung - Effizient picken und packen.
München: Heinrich Vogel, 2009, S. 30-54.

[tHSB11] ten Hompel, Michael; Sadowsky, Volker; Beck, Maria:
Materialflusssysteme 2 - Planung und Berechnung der Kommissionierung in der Logistik.
Berlin/Heidelberg: Springer, 2011.

[VEN10] Venn, Eric:
Beitrag zur simulationsgestützen Konzeptplanung von heterogen strukturierten Kommissioniersystemen.
Dissertation, Universität Duisburg-Essen, 2010.

[VG11] Venn, Eric; Geißen, Tim:
Kommissionieren mit System - Mit acht Bausteinen erfolgreich planen.
In: Hebezeuge und Fördermittel 51, 2011 (6), S. 338-342.