Data Requirements for Planning of Material Flow Systems

Description and Explanation

Summary

This document describes and explains the most important requirements for customer data as planning base for material flow systems.

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1 Introduction

This document describes and explains the most important requirements for customer data as planning base for material flow systems. Data analysis is a fundamental step in the planning of material flow systems for it translates raw data into understandable and usable information. Different systems can have different requirements with respect to scope and depth of data analyses, yet the general information requirements for planning remain the mostly identical.

The data analysis process can be complex and error prone, and the quality of the resulting planning information is highly dependent on the quality of the available input data. In case of questions about raw data requirements, reach out to us in order to avoid unnecessary iterations of the analysis.

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Revision History of Document

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2 Objective of Data Analysis

The optimal design of material flow systems is highly dependent on the specific requirements of the customer. Besides, and in addition to, proper understanding of process requirements, the results of the analysis of customer data provides the planning base to derive design decisions for the material flow system. Also, the resulting planning information represent the basis for the dimensioning of the system's scale.

Since data analysis as such is fundamentally concerned with historical data, a necessary step is the adjustment and extrapolation of the planning information with growth expectations. Because growth expectations have a high degree of uncertainty, the resulting planning base must be understood as an *approximation* of future requirements.

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3 Required Data Sets

Different data sets are required as input for the data analysis. Below tables provides an overview. More detailed explanation is provided in the following sub chapters.

Data Set	**Short Explanation**
Master Data	Data table containing all relevant products (**S**tock **K**eeping **U**nits, SKUs) and their physical properties (dimensions) and requirements (e.g., temperature)
Order Data	Data table containing customer orders
Working Hours per Day	The daily working hours available to carry out logistics operations
Growth Expectations and Design Year	The material flow system will be designed to fit future business requirements. Accordingly, it is important to understand growth expectations up to a target *design year*.

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3.1 Master Data

The master data – or item master file – consist of a table of all relevant SKUs and their physical properties and requirements. Relevant SKUs are all SKUs which are to be considered for the material flow system under planning. Also, in order to be able to derive requirements for storage systems, it is generally helpful if the master data contains a snapshot of the current inventory level of the respective SKU.

Experience shows that master data is often incomplete, and even more often it is wrong. While we do carry out plausibility checks (e.g., check for items with improbable weight or size), it can be stated that better quality of raw data leads to better quality of planning results.

Upon detecting implausible data, it needs to be decided what should be done with such data sets. If the implausible data concerns only a very small share of SKUs, and only those with very low throughput and thus little impact on system design, it can be agreed with the customer to delete such data sets. Deleting more significant numbers of implausible or false data, however, can distort the results of the data analysis. In such a case it might be more appropriate to make assumptions about missing weight and size of these SKUs, e.g. by replacing missing or obviously wrong dimensions with average dimensions derived from the remaining SKUs. Either way, it will be necessary to have a brief conversation about the quality of master data and how to proceed upon us having carried out first plausibility checks.

3.1.1 Data Requirements

Type of Data	Explanation
Required Data	
Item Number	The unique identifier of each SKU, typically a numerical or alphanumerical code.
Item Name	The plain text name of the SKU
Weight	Weight of the SKU. Make sure that the physical unit used is the same across all SKUs (i.e., always gram OR always kilogram OR always ton). Importantly, the weight needs to refer to the pick (=sales) unit. If you sell individual cans of beans, it is necessary to have the weight of an individual can of beans – not the weight of the full warehouse case containing 12 cans of beans.
Length	Length of the SKU. Make sure that the physical unit used is the same across all SKUs (e.g., always millimeter). As with weight, make sure the length refers to the length of the actual pick (=sales) unit.
Width	Width of the SKU. Make sure that the physical unit used is the same across all SKUs (e.g., always millimeter). As with length, make sure the width refers to the width of the actual pick (=sales) unit.
Height	Height of the SKU. Make sure that the physical unit used is the same across all SKUs (e.g., always millimeter). As with width, make sure the height refers to the height of the actual pick (=sales) unit.
Pick Unit	Statement about the physical pick unit, e.g. an individual piece, a box (containing several pieces), or a pallet (containing several boxes).

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Inventory Level	A snapshot of the inventory level form the day the master data was extracted from the database. Preferably this should be either a representative value or a value relevant for the planning (e.g., a high value representing the storage levels right before important seasonal business). Make sure the inventory level is based on the defined pick unit.
Depending on the specific project, the following data may be required:	
Number of pick units per transport (replenishment) unit	The number of pick units per superordinate transport unit, e.g. the number of cans of beans per carton of canned beans. This is particularly important data if the replenishment process is based on different units than the pick unit (e.g., the picking zone is replenished with full cartons, but pickers will always pick individual items out of these cartons).
Pallet Ti	The number of cases (transport units) per layer on a pallet
Pallet Hi	The number of layers per pallet
Sensitive Item / Crash Class	In some projects, it is important to know if SKUs are particularly sensitive or can be dropped during the picking process. This data is important for performance considerations, as well as for storage systems and even picking concepts. In some cases, items need to be classified into crash classes so as to be able to determine a picking and packing sequence. In this case, the crash class of the individual items should be noted in the master data.
Lot Number	In some industries, it is important that lot numbers be not mixed. Depending on the storage system and principle (e.g., FIFO), this can result in higher storage requirements as different lot numbers are treated similar to different SKUs.
Dangerous Good / Product Group	In some projects, some projects need to be flagged as dangerous, flammable, or explosive goods and need to be kept in separate storage areas. Sometimes there are more diverse product groups with implications for the storage system and setup, in which case such product groups should be noted in the master data.
Temperature Zone	If SKUs have particular temperature requirements, this information needs to be provided as part of the master data.
Other characteristics	Any other characteristics, data or information with potential implications for the material flow system design.

3.1.2 Exemplary Extract from Master Data

Item Number	Item Name	Weight [g]	Length [mm]	Width [mm]	Height [mm]	Pick Unit	Pick Units per Case	Temp Zone
295220	Fusilli Pasta	500	400	400	20	Case	4	Ambient
223481	Roll-on Deodorant	484	155	104	115	Case	6	Ambient
386995	Milk	1100	90	59	206	Piece	8	Chilled

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3.2 Order Data

The order data consists of all customer orders relevant to the new material flow system. Based on the order data, we determine the dynamic performance requirements of the material flow system.

Depending on the project, order data can produce extremely large data sets. Order data should comprise customer orders of at least two full weks but does not normally need to comprise more than one year of customer orders. Rather than expanding the time horizon the data covers, it is more important that the time period chosen is representative for the requirements on the material flow system. When the difference between “average days” and “peak days” (e.g., Christmas season) is particularly high, it can be advisable to choose (separate) data sets such that one average period and one peak period be covered.

3.2.1 Data Requirements

Type of Data	Explanation
Required Data	
Order Number	The unique identifier of each order, typically a numerical code or alphanumerical code.
Item Number	The unique identifier of each SKU, typically a numerical or alphanumerical code.
Date	The date of either registration of the order in the system *OR* of picking *OR* of shipping. This is important to understand. Preferably, date of picking and date of shipping should both be represented in the order data in separate columns if there is a time difference. In this case, not only date but also *time* would be important information.
Quantity	The number of items picked. Additionally, information about the exact pick unit is necessary (see below).
Pick Unit	Statement about the physical pick unit, e.g. an individual piece, a box (containing several pieces), or a pallet (containing several boxes). This is necessary to know to understand if items are picked and shipped in varying units (e.g., sometimes as single piece, sometimes as full carton containing several pieces).
Depending on the specific project, the following data may be required:	
Time	As with date, it is important to distinguish between order time, picking time, and shipping time. The exact times are of particular importance if the load on the material flow system varies throughout the day. Some IT systems capture start time and end time of picking, which can be useful to understand how crowded picking aisles are with pickers, should this be of interest.
Customer Number	The unique identifier of the customer
Shipping Load Number	If the analysis needs to include detailed goods-out sortation and similar, it will be necessary to know shipping load numbers so as to be able to understand sortation requirements.

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3.2.2 Exemplary Extract from Order Data

The data set should contain all order lines in chronological order, that is every SKU ordered as part of each order for the given time period represents a separate line in the table.

Order Number	Date of Pick	Time of Pick	Item Number	Pick Quantity	Pick Unit	Customer
FR20201012	2020-05-02	08:35:45	295220	1	Case	JEB6203
FR20201012	2020-05-02	08:35:59	223481	2	Piece	JMB1188
FR20201013	2020-05-02	08:36:22	295229	4	Piece	RAB0687
FR20201014	2020-05-02	08:36:47	293441	2	Pallet	KWH3001

3.3 Working Hours, Growth Expectations and Design Year

In order to understand the performance requirements the material flow system needs to fulfill, it is necessary to know the daily working hours. They should be provided in simple table format.

Day	Morning Shift	Day Shift	Night Shift
Monday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Tuesday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Wednesday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Thursday	05:00 – 13:00	13:00 – 21:00	21:00 – 05:00
Friday	05:00 – 13:00	13:00 – 21:00	-
Saturday	05:00 – 13:00	13:00 – 21:00	-
Sunday	05:00 – 13:00	-	-

Since new systems are rarely planned for the status quo but are intended to fulfill future requirements (after all, some time will pass between the day the raw data is pulled from the IT systems for data analysis and the day the new material flow system is put into operation). It is important to agree on a *design year* and the *growth* the company expects to experience each year until the design year. The performance requirements in the design year will normally represent the benchmark for the acceptance test of the new system.

4 Requirements for Data Format

The data analysis will be carried out mostly through database operations. This requires that the raw data is provided in a format which can be uploaded to our database system.

Acceptable formats are

- .txt or .csv files
- .xls or .xlsx files (Microsoft Excel)
- .mdb or .accdb files (Microsoft Access)

Receiving the data in other formats then the above may require additional time and effort. Kindly make sure that all columns are properly named so they can be identified by the data analyst.

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