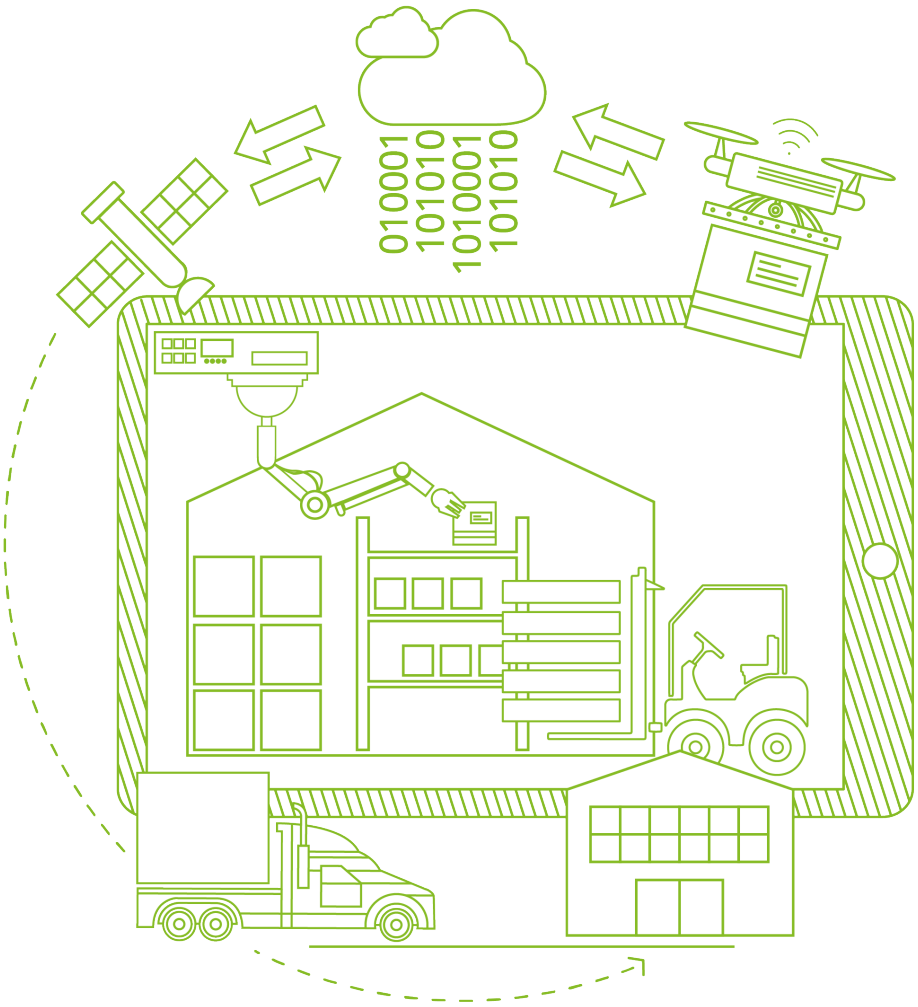
Deloitte.



Green Logistics with SAP EWM

Resources Optimization

MAKING AN IMPACT THAT MATTERS since 1845

Supply chains are in continuous change, as market trends and customer habits are continuously changing. One of the persistent drivers of this is that more customers and businesses are becoming committed to reducing their impact on climate change and want to increase their contribution to environmental protection. Some businesses see this customer behaviour also as a chance to grow their market share by repositioning themselves in the market as environmentally responsible brands. This requires them to improve their environmental impact and reduce their yearly carbon footprint. Logistics activities are one of the major contributors to the total CO2 emissions in manufacturing companies. Minimizing the environmental impact of logistics without jeopardizing business operations is the standard approach that enterprises follow when moving towards green logistics. This requires optimizing logistics activities and increasing their efficiency. However, the optimization of logistics can be very challenging for some enterprises, as the enterprise logistics are part of the whole logistics that often spread across the whole supply chain.

Typical challenges

The transformation towards green logistics greatly depends on the involved resources, the technology infrastructure and the logistics systems that are deployed. Poor system integration or system configuration result in low performance efficiency in addition to underutilization or overutilization of resource capacity. Typical examples of this are seen in warehouse logistics such as the following challenges:

Capacity Limits

WarehouseDelays

Inefficient Processes

Energy Consumption

Safety Hazards

Some warehouse management systems offer integrated solutions for warehouse management, labour management and resource management. However, the configuration of these systems is not always based on the actual capacity of warehouse operators and warehouse resources. **Limited capacity** can cause deviations between planned and executed workloads in warehouse management systems.

Delays in performing workloads are often related to the limited capacity of the warehouse operators or warehouse resources and can occur when warehouse operators are preoccupied with other unplanned workloads, when warehouse resources are unavailable or when the warehouse processes are not carried out in the warehouse management systems accordingly.

Incomplete or delayed workloads result in **inefficient putaway or picking processes**, which in turn lead to congestion at the goods receipt or goods issue zones of the warehouse. Congestions at the goods receipt zone can result in delays in processing upcoming deliveries, creating traffic at warehouse gates, delays in the production supply or shortage in materials. Congestions at the goods issue zones can lead to changes in the transportation schedules, delayed customer orders or customer complaints.

Inefficiency in carrying out the warehouse processes is not only translated into more time required to carry out these processes but also **higher energy consumption.** This includes the energy needed for heating, cooling, air conditioning, lighting, IT equipment, battery charging and most important for powering warehouse vehicles and forklifts.

Warehouse **safety hazards** can be fatal and can leave serious human and financial damages. Vehicle accidents are the most common warehouse accidents and forklift accidents make up a big portion of all warehouse accidents caused by vehicles. Statistically, the probability of these accidents is proportional to the operation time or distances driven and it increases when there are no predefined routes or predefined warehousing procedures for driving forklifts or warehouse vehicles.

Resource optimization through travel distance calculation

Most of the prementioned challenges are directly or indirectly related to the capacity of warehouse operators or warehouse resources. However, the risks and impact of these challenges can be minimized using a warehouse management system that integrates warehouse management, labour management and resources management and optimizes capacity utilization.
The outcome of this should result in **increasing the efficiency of warehouse operators** and the **improving utilization of warehouse resources**. One of the common solutions for this is optimizing travel distances that a warehouse operator or resource travels across the warehouse when carrying out a warehouse task. This optimization can be realized through a pre-calculation of distances between the different warehouse areas and storage bins, and predefining the optimal routes needed to perform the warehouse tasks in each of these areas. Afterwards, an **automation of travel distance calculation and route determination** and can be achieved. This automation provides the warehouse operator or resource with the optimal route between the warehouse bins in order to carry out a certain warehouse task and thus, it reduces redundant distances travelled and the extra time needed.

Route optimization can be tackled in multiple ways. In a warehouse with different resources that operate at various speeds and different capacities, path finding algorithms can be implemented to calculate the minimum travel distances. These algorithms determine the path with the shortest distance between the stops for putaway or picking tasks. In combination with the resource speed and labour standards for manual tasks, the time needed to execute a given task can be estimated. This estimation enables the warehouse operator or resources to have less waiting time and minimized delays. By combining state of the art optimization techniques with the overall end-to-end process of logistics and fulfilment, SAP EWM addresses logistic issues and enables organizations to optimize warehouse operations.

How can SAP EWM help

SAP EWM facilitates resource optimization through the Travel Distance Calculation. It computes the necessary distance a warehouse resource must travel during a picking or a putaway process. In combination with the Labour Management functionality, it can determine the whole duration of a warehouse task. The main goal of the Travel Distance Calculation is on one hand to calculate the latest start time for a specific warehouse task to be executed and on the other hand to calculate engineered labour standards (ELS), which describes a defined amount of time for a trained worker with sufficient pace and undergoing random delays to deal with a specific amount of work.

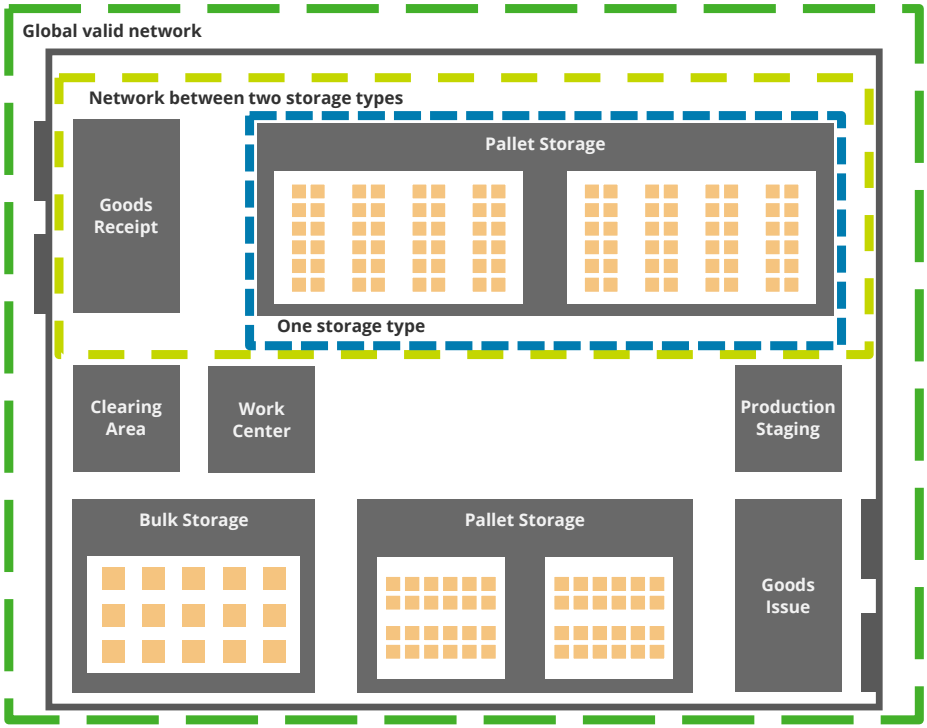
EWM offers Travel Distance Calculation on three different levels of a warehouse. The scale with the most effort but also the highest potential for improvement is to optimize all routes in the warehouse through building a **global network** with multiple storage types. If Travel Distance Calculation is required in only a part of the warehouse, a valid **network between two storage** types can be defined. When there are fixed handover stations and warehouse tasks that are not assigned to multiple storage types, the minimal approach can be implemented, which only calculates the distance **within a storage type.**

For every warehouse order the Travel Distance Calculation is carried out twice. Once during the warehouse order creation to estimate the needed time and once after the confirmation, when the used resource is selected.

Types of distance calculation

In the first step the possible routes in the Warehouse are determined. There can either be direct routes between different storage bins or routes in a network. When using the direct distance calculation, the length is specified by the **Euclidean** (beeline) or **Manhattan** distance. The Manhattan metric determines the shortest distance between two points when following the lines of a grid. The direct way without considering paths or obstacle like racks is used. In comparison to that, the **network-based distance calculation** uses predefined edges (e.g. aisles) and nodes (e.g. crossings and bins) in the warehouse to determine possible routes.

Scale of implementation



While the latter is more complicated in the setup and needs a longer computation time, it leads to a more detailed solution and its determined path can be directly used by the executing resource.

Assumptions for route determination

The first estimation of the travel distance is based on three generalizations, as the final parameters are unknown.

All possible routes are used without any resource restrictions.

A default distance is included to model the path of a resource to the starting point.

The speed is calculated based on the slowest resource to map the worst case.

The system then saves the results in the planned workload. When the executing resource is determined, the Travel Distance Calculation is updated with the exact parameters. This allows a rough estimation of the workload to be made and provides better utilization of the operators and resources.

Route determination

In order to ensure a reliable solution and simulate the route in a short time EWM offers two heuristic approaches by default, however other individual heuristics can also be included.
The **Depth-first search:** it attempts to find a route between the specified nodes of a network in the shortest time possible. The search runs here in the direction of the start node to the end node. The search is completed when the first complete route is found.

The **Breadth-first search:** it looks for all possible routes in the network and selects the one that has the shortest distance. This heuristic is more performance intensive at runtime and is only appropriate for small-sized networks.

The selection of the heuristic must be done manually and should consider the warehouse size, quantity of warehouse tasks and the available computing power. These factors are necessary, because there is a trade-off in the quality of the result between distance and the needed computing time.

Travel time calculation

Once the route is determined the Time Calculation is performed. It determines the workload and utilization of operators and resources as well as the latest possible start time for a warehouse task. The standard calculation separates the vertical and horizontal movement. Simultaneous movement in both directions is not possible.

Total travel time = [horizontal distance / horizontal speed] + [vertical distance / vertical speed].

Enhancement possibilities

However, since this is not an accurate representation of movements in most warehouses, SAP offers a more detailed approach using an enhancement of EWM called BRF+ (Business Rule Framework plus). This enhancement enables the inclusions of individual rules and calculations that are relevant for a specific warehouse. These can consider not only the distance between stops, but also detailed path information like turns, length of straight segments and the time needed at each stop. A more complex ruleset leads to a better planning and thus to a better resource utilization and optimization.

Conclusion

The possible approaches towards green logistics vary according to the industry, scale of operations and the defined criteria for logistics optimization.

On the other hand, the available system solutions on the market vary as well in terms of functionality and field of application. SAP EWM with its comprehensive scope of functionalities guarantees optimized processes within the warehouse across warehouses in medium-sized and large enterprises.

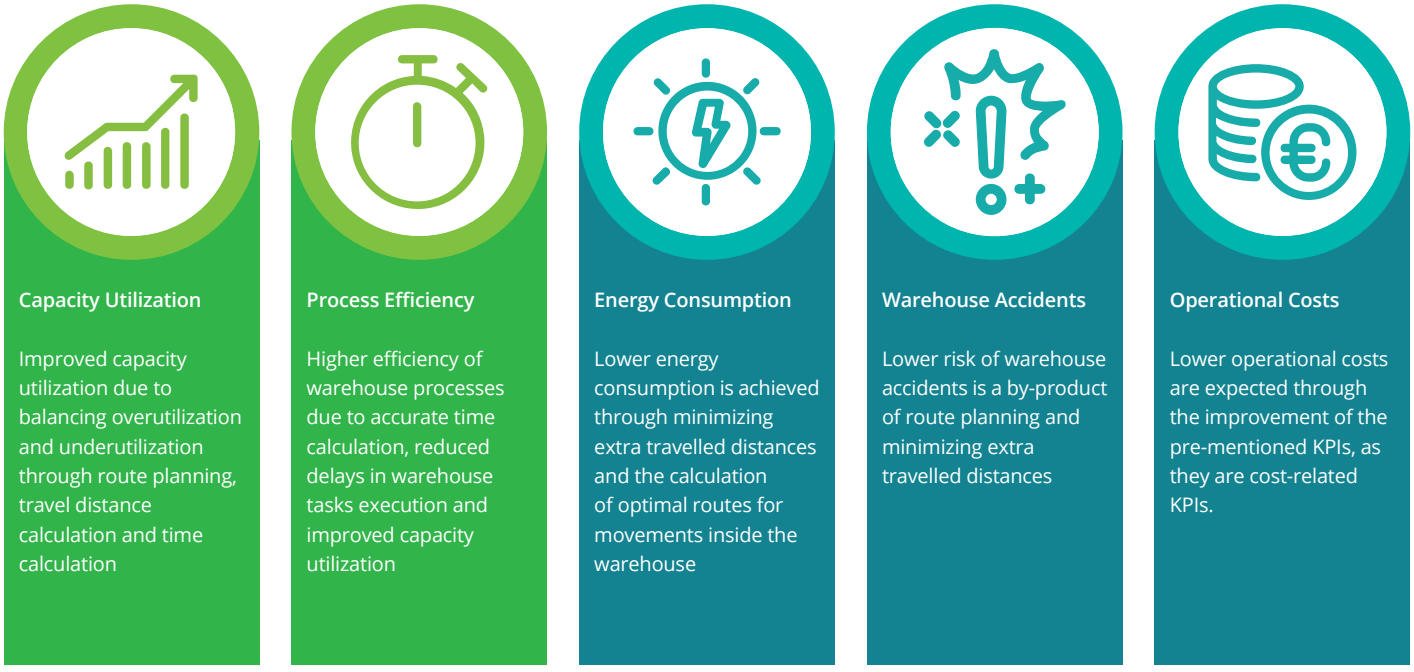
The SAP EWM Travel Distance Calculation solution that has been introduced in this study, is one of the tools that SAP EWM provides for optimizing the utilization of the warehouse resources and the movements of these resources within the warehouse. It can be implemented on a minimal, medium or large scale depending on intended approach and it also helps improving the following warehouse KPIs:

Why Deloitte

Deloitte has a worldwide network of SAP Subject Matter Experts and offers clients a host of services in warehouse management transformation, both in core SAP implementations as well as assessments and evaluations. By leveraging leading industry practices, championing cutting edge capabilities and drawing on lessons learned from prior transformations, Deloitte has successfully delivered tailored solutions to meet individual customer needs. Furthermore, Deloitte's comprehensive approach to SAP EWM Implementations offers proven methodologies, accelerators and innovations.

Deloitte is also pleased to have received a 2021 SAP® Pinnacle Award as the SAP S/4HANA® Partner of the Year–Large Enterprise Companies, which recognizes its outstanding contributions working with SAP. Within the implementation projects in different industry sectors, Deloitte has a huge experience in SAP implementation as well as optimizing the logistical processes.

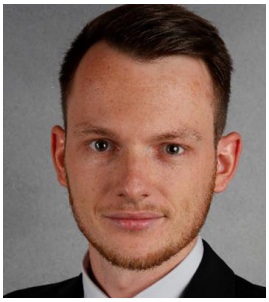
Deloitte can help your enterprise in optimizing logistical processes and stepping towards green logistics. Being a leading consulting company in addition to having extensive knowledge in supply chain transformation and logistic execution, Deloitte has proven its expertise in major SAP S/4HANA and SAP EWM implementation and rollout projects at global players and across different industries.



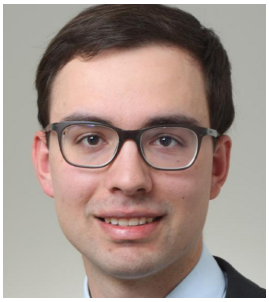
Contact us

Theophilos Kotzaeroglu
Director
Tel. +49 1515 8072 314
tkotzaeroglu@deloitte.de

Bassel Bahsas
Senior Consultant
Tel. +49 1515 8000 450
bbahsas@deloitte.de



Lucas Heppenstall
Consultant
Tel. +49 1511 8295 905
lheppenstall@deloitte.de



Adrian Elter
Consultant
Tel. +49 1515 4484 644
aelter@deloitte.de

Deloitte.

Designed by CoRe Creative Services. RITM1372333