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Why are distribution centers getting bigger and bigger?
The last 10 years has witnessed a trend in which distribution centers are getting bigger and bigger, especially DC's of logistics service providers but also to some extent private DC's. It is questionable if this is always the best solution. There are without a doubt scale advantages associated with a DC of 10.000 m² compared to a DC of 5.000 m², but are there also scale advantages of a mega-DC of 50.000 m² compared to a DC of 25.000 m²?

Reasons why DC's are getting bigger and bigger are
For DC's of logistics service providers:

- Campus: pool of labor, that can flexibly be divided over the operations (however, this is sometimes difficult in practice)
- Less overhead costs, shared services
- Flexibility to phase in and phase out client operations.

For private DC's:

- Centralization of stock
- Consolidation of transport flows
- "Keep it simple". Six DC's on the map of Europe looks better than 26.
- Management attention. Every DC requires attention and less DC's require less attention. However this is not always true.
- DC's that perform badly and DC's that are starting up require a great deal of attention. An efficient warehouse operation however requires only a little management attention. What really requires a lot of management attention is to do a warehouse tender every 2-3 years and frequently changing to another service provider.
- Opportunities for mechanization.

Cons of mega DC's are

- Longer driving distances (see separate section in this article)
- Less overview on the operation.
- For example on the shipping floor, in many warehouses there is an office on the shipping floor, from which the total area can be overseen. This helps in quickly identifying problems and delays. When the shipping floor is over 100 m long, this becomes problematic.
- A mega-DC requires good organization of shipping and receiving, starting with dock management, ensuring trucks are sent to the correct dock, well-marked loading- and unloading areas, fast clearance of the floor.
- Risk.
- A mega-DC requires a mega-investment. What happens with the business case when the increase of outbound volumes is lower than expected? And for logistics service providers: what happens if we lose a big customer? Also the start up problems for mega-DC's tend to be bigger than for smaller DC's, which is also a risk.

Longer driving distances
To calculate the impact of the size of the DC on the productivity of warehouse operators, a theoretical case is analyzed. Assume that we have a standard warehouse

lay-out with wide aisles, reach trucks and order pick trucks. Order picking is done for SKU's that are spread over the entire warehouse.
To limit driving distances, ABC classification is used and there are sufficient switching aisles in the lay-out. FTE are rounded up, for example 3.5 FTE are rounded to 4 (14% increase) and 13.5 FTE are rounded to 14 (only 4% increase).

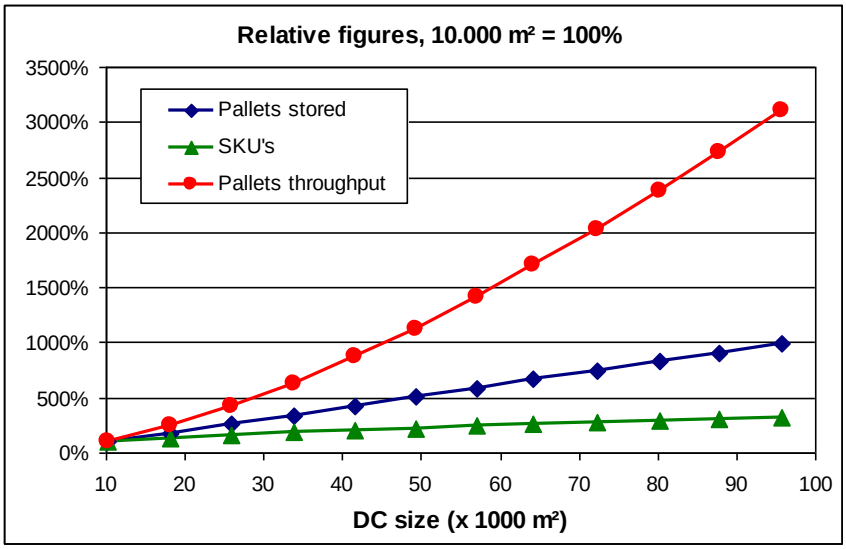

Figure 1: basic data

Figure 1 shows the basic data for this case, for increasing size of the DC (10.000 to 100.000 m²) The storage capacity in number of pallets increases 1 to 1 with the square meters: a DC of 100.000 m² has 10 times more capacity than a DC of 10.000 m². It is assumed, that the number of SKU's increases less than 1 to 1 and that the number of pallet movements (throughput) increases faster. Because of centralization of stock, the number of days of inventory (DOI) decreases.

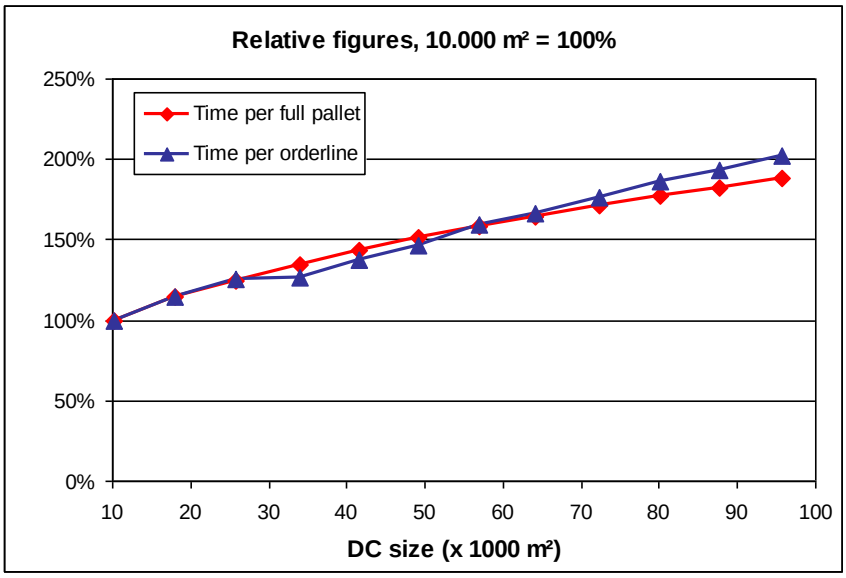

Figure 2: productivity

Figure 2 shows the productivity of pallet handling and of order picking for increasing DC sizes. Because of longer driving distances, the time per pallet and the time per order line for a DC of 50.000 m² is about 50% higher than for a DC of 10.000 m².

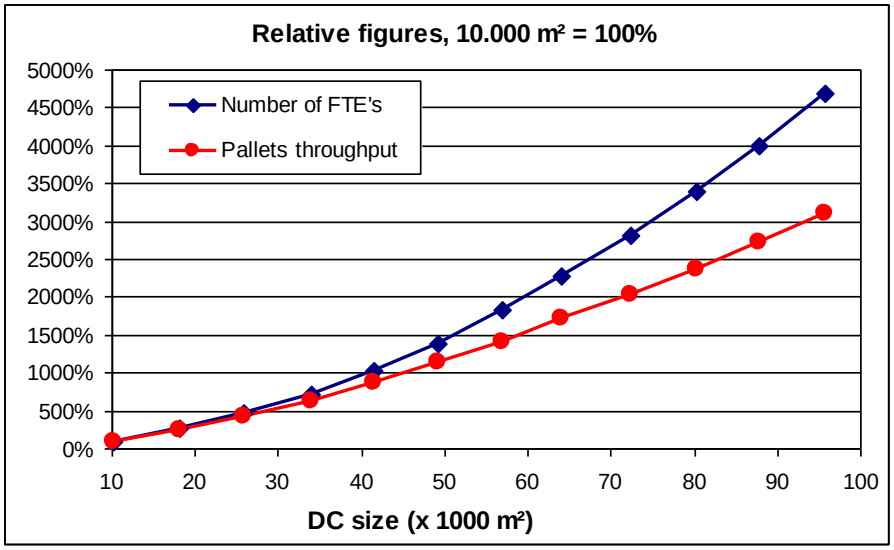

Figure 3: number of warehouse FTE's versus number of pallets and orderlines

Figure 3 shows the impact of lower productivities. The number of warehouse FTE's (blue collar) increases faster than the number of pallets and order lines to be handled, especially for DC's bigger than 30,000 m².

It has to be said that these figures are based on a theoretic model and that the reality can be different. For example, it might be possible to limit the driving distance for receiving, by selecting a dock door close to the area where the products are stored. It might also be beneficial to separate the order picking area into several smaller areas. Also, mechanization is not taken into account, for example goods to man systems, batch picking with a sorter and conveyors. With increased volumes and scale, the business case for mechanization becomes better.
Are there other scale advantages?

Scale advantages
Usually one DC of 10.000 m² is more efficient than 2 DC's of 5.000 m² each, because of scale advantages. For example operators can be used flexibly, less overhead (supervisors, warehouse manager, IT support, facilities) and no coordination between two separate sites.

But is one DC of 50.000 m² also more efficient than 2 DC's of 25.000 m² each?

For example, let's look at a big company that wants to centralize 3 existing DC's into one mega-DC. All DC's, the old ones and the new one, are outsourced. Via centralization, cost savings are achieved on inventory costs and inbound transportation. Outbound transport costs increase. Also a considerable saving will be realized on warehouse costs, because of scale advantages. At least this is the general expectation.

Because of centralization of stock, the stock level will decrease and therefore less m² warehouse space is required. This is indeed a cost savings. On the other hand, there is the problem of increasing driving distances. Maybe this can partly be solved by separating the warehouse into areas per product group and by doing receiving and shipping as close as possible to the storage location.

Are there other scale advantages? The logistics service provider will not invest in mechanization, because the company wants to have a contract of max 2 to 3 years. There are advantages that can be gained by better usage of labor, however if the operation becomes bigger than 20 to 30 FTE's per shift, then the additional opportunity becomes small. The existing 3 DC's all have an outbound peak at the end of month, so spreading the capacity is not possible. The number of supervisors will increase at the same level as the number of warehouse FTE's (usually 1 supervisor per approximately 10 FTE).

What about less management attention with less DC's? As mentioned in the introduction, the amount of management attention mainly depends on the frequency that a company moves to another logistics service provider. We believe that it is better to develop a stable relation with a service provider that lasts more than 2 years. The first year, a DC costs money (tender process, moving, start up problems), the second year usually is break-even and after the third year cost savings are achieved via improvement projects and better collaboration.

Optimal size of a conventional DC

What is the optimal size of a DC? For conventional DC's we believe not more than 20 to 25.000 m², if a DC is bigger than this, it becomes less efficient. This figure is based on experience, not on calculations.
In order to make a bigger DC efficient, a clear split into several smaller units is required, each with an own receiving and shipping area or by applying mechanization.

For logistics service providers, it can be bigger

For a logistics service provider, a mega-DC can be interesting, especially if it consists of several smaller units for different clients. Big advantages of a mega-DC or campus are: shared services and flexibility to in- and outphase customers. The service provider must make the important decision whether or not they are willing to take the risk that sufficient clients can be found to fill the warehouse.

For private warehouses: look at the bigger picture

As this article shows, bigger is not always better. To achieve scale advantages with a mega-DC, often mechanization is required. Mechanization is only feasible for private warehouses and (sometimes) for outsourced warehouses where there is a long term contract. On the other hand, smaller is not always better. One has to look at the big picture. What is the function of the DC in the supply chain? Is there consolidation of transport loads because of the mega-DC? What is the impact on inventory levels and costs?

In order to make the right decision, a distribution network study is required that covers all elements.

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Rob Wijnen is Senior Consultant at Groenewout. After receiving his degree in Mathematics at the Technical University of Eindhoven, Rob started at Groenewout in 1993 as simulation consultant and has done many projects since then spanning a wide range of logistics areas. He specializes in modeling, data analysis and the development of tools in Access and Excel. Rob has a significant amount of experience in designing and improving warehouses, optimization of distribution networks and inventory- and production planning. In addition, he shares for several years his expertise via the training course "Data analysis in Access".