

Developing a Framework to Support a Design Science Approach to Warehouse Design Projects

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As many of those who ever tried to develop a new warehouse layout have experienced, designing a warehouse is a highly complex task. Especially since many of the needed decision are highly interdependent. Therefore, a decision support framework, which uses a module based approach inspired by design science, was developed in order to support a structured and theory-based approach to decision making.

Even though companies nowadays are measured on several success criteria, cost of operations is still one of the main drivers of a company's bottom line. For producing companies in general, operations are often viewed from a supply chain perspective, where warehouses and warehousing operations are often considered as some of the most crucial elements. Elements that often stands for over 20 percent of a company's total logistics costs. The actual size of these costs are, together with most of the costs related to warehouse operations, mainly consequences of the decisions made when designing the warehouse. The design of warehouses should therefore be considered as a critical component for any company striving towards increased competitiveness and a more efficient supply chain. However, warehouse design consists of several aspects, including location and size of aisles, P/D location, picking zones, storage assignment and many more. These aspects are often interdependent, thereby making it almost impossible to find an optimal solution to the layout design problem. A structured approach towards decision making is therefore needed.

In order to approach this issue a decision support framework was created by combining warehousing theory with the methodology of design science. By studying research within the respective fields, frameworks related to both of the topics were established. The design science research framework combines the viewpoints of current research and puts it in a warehouse design context. This framework were then combined with modules, consisting of key topics from the warehousing literature study, in order to create the decision support framework. The modules are; initial goals and limitations analysis, SKU analysis, layout options, operational policies and equipment.

The framework merges certain concepts from the design sciences with common warehousing theory, suggesting a structured approach to the complex problem of designing a warehouse. The approach aims to divide the design problem into smaller sub-problems and thereby boost manageability. One or possibly a few feasible solutions are developed, with the initial goals and limitations in mind.

The model aims to help novices as well as professionals to approach design problems in a more structured manner. There is still only little research made that combines design science and traditional warehousing theory. By this contribution, the authors hope to show the potential of combining these fields and the great benefits to be achieved by doing so.

The framework was applied to the situation at BorgWarner Sweden AB using a single case study research strategy. The case study shows that the use of the decision support framework resulted in an improved detailed layout that are in line with the strategy of the case company. The entire study and the suggested framework can be accessed in the report *Developing a Design Science Based Decision Support Framework for Detailed Design of a Warehouse*.