Distribution Center Location for Small Fast Growing Companies in the Nordics

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Strategic decision related to logistics are often imply significant investments. Choosing a location for a central warehouse that can remain in place for several years is therefore very desirable. For small, fast growing companies with uncertain future growth and, commonly, limited amounts of data, this can be a challenging task.

Introduction
Making strategic decisions concerning logistics and the supply chain of a company are generally associated with large investments and with long-term results in mind. The effects of these decisions will be noticeable for many years. For this reason, it is of high interest that the possible outcomes of such decisions are evaluated thoroughly. Especially for small, fast growing companies, making the right move in these situations can potentially determine the fate of the business.

An interesting example of such a decision is the location of the distribution center. Determining the best location requires insight both in historic data and future strategic direction. Which geographic areas will be targeted in the future? Where can we expect growth and how much? Which are the most likely scenarios? How do our logistics look today? These are central questions in the context of distribution center location. Having studied relevant literature and scientific papers on the subject, there is more to be said about how to answer these questions for small fast-growing companies in the Nordics. Consequently, it became the focus of the study and a case company was found, which enabled in depth research of the problem.

Purpose
The purpose of the study was to analyse the situation and needs for small fast-growing companies in the Nordics and develop a framework that could be used to determine the optimal location for a central warehouse in order to minimise distribution costs. This was done by firstly researching what aspects that were important to consider and secondly by researching how the optimal warehouse location, from a distribution cost perspective, can be determine given the relevant aspects. Looking at small, fast growing companies is especially interesting as future demand is often very uncertain, both in terms of volume and geographic location.

Methodology
The method used to fulfil the study was a single case study along with operations research methodology. Using a small company, referred to as The Company, distributing fast moving consumer goods on the Nordic market as a case company to study in detail.

A case study can be based on a single or multiple cases, both with their respective advantages. The single case study was chosen for this project as single case studies can provide deeper in depth understanding rather than empirical generalisations (Patton 1990). The case chosen for the study, The Company, can be considered a typical case by Patton’s
definition, the reasons being that The Company is not selling a unique product, the specific shelf life of the product is not a determining factor for the study and thirdly because the study is limited to warehouse location in the Nordics. This can be considered typical for a small, fast growing company on the Nordic market.

Theory
Apart from relevant aspects of logistics, distribution networks and other fundamental principles of supply chain management, there are two main areas that comprise the theoretical foundation of the study. The first is the theory behind facility location modelling, the second is the theory about how to handle uncertainty.

To understand more about facility location modelling, a taxonomy presented by Daskin 1996 was used to be able to categorise the problem of the company. The taxonomy consists of a list of 13 parameters to decide upon, for example what distance metrics to use and if the facility to be located has capacitated or un-capacitated performance. Thereafter, an appropriate way of modelling the problem mathematically needed to be determined.

Three categories of location modelling problems were studied in great detail, the median problem, the covering problem and the center problem. The median problem determines how to locate p facilities so that the total demand-weighted distance travelled between facilities and demand nodes is minimised. The covering problem solves how to locate an endogenously specified minimum number of facilities in order to never exceed a predetermined maximum distance travelled from any demand node from a facility. In other words it makes sure that no demand node is too far from a facility, which is interesting to look at for example when locating fire stations. Finally, the center problem aims to minimise the maximum distance travelled to a demand node by location p facilities. (Owen & Daskin, 1998) As the problem of The Company was to minimise total transportation costs, the median problem was the most suitable one to use.

As there are many possible futures for The Company and other similar businesses, it became an essential part of the task to build a framework which could provide output based on many different predictions about the future at once. The scenario planning approach provided a usable solution to the problem. Scenario planning is used to optimise a system based on many different plausible scenarios, which in turn can be based on forecasting or expert knowledge and experience. The system can be optimised to achieve one of three goals:

1. Optimise the expected performance over all scenarios
2. Optimise the worst-case performance
3. Minimise the expected or worst case regret across all scenarios

Regret is a measurement of how much worse the suggested solution, in the case of this report the location of a warehouse, will perform when compared to the optimal solution for the actual future scenario when it is realised. (Vanston et al., 1977) Minimising expected or-worst case regret became the focus of the study as it prevents any solution from being too far from the optimal one in each scenario.

One year of delivery data for The Company was used and the problem was structured in accordance with an adapted version of Daskin’s taxonomy.
The median problem could then be solved for all scenarios, through linear programming, in order to find the solution generating the minimum amount of regret.

Conclusions
As a result of the study, conducted using relevant theory and data from The Company, a framework for distribution center location for small, fast-growing companies could be developed. A complete overview of the framework is presented in Figure 1. The framework is intended to function as guidance for decision makers in the decision of relocating a central warehouse.

To gain more insight in the topic of the study, it could be interesting to conduct further studies using multiple cases in order to test and sharpen the framework and gain new insights. Some properties of the model could be evaluated further, such as how demand elasticity would affect the output.

References
Patton, M. (1990), "Qualitative evaluation and research methods", Sage Publications

![Figure 1: The framework for distribution center location for small, fast-growing companies](image-url)