

## A Structured Approach to Distribution Network Design Assessment

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*This article aims to explain the overall structure of an evaluation tool that can be used to assess how beneficiary a certain distribution network might be for a specific company. The evaluation tool has been developed in a case study, and is hence designed in order to best measure the objectives and business climate of the case company – Ericsson. However, the tool can be adapted to suit other organizations, which is why this article also explains the procedure that was used to develop the tool. Finally, some advantages of this tool in relation to others are presented. This article is based on some of the findings from the case study. The case study is presented in its full version in the Master Thesis “Creating Structure in an Ad Hoc Environment – evaluation of a distribution network design at Ericsson BNET”.*

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### ***The evaluation tool***

The high-level structure of the evaluation tool, which in nature has many correspondences with the Analytical Hierarchy Process (AHP), is depicted below. The *Evaluative Criteria*, which are the ones that the ultimate recommendation depends on, are *costs*, *value to customers* and *other parameters relevant to the case company’s competitive ability*. These evaluative criteria are meant to be generic in the sense that they are derived from literature, and aims to address aspects that current research assign status as important aspects to address when evaluating a distribution network design. As good as all of the reviewed literature acknowledge costs as one of the most or *the* most important parameter to assess when evaluating a distribution network design. Robinson & Swink (1994) claim that the objective of a network design is to minimize total system costs, which is why costs was assigned the status of an evaluative criterion. The authors further suggest that the network designer needs to address the trade-off between transportation costs and costs for setting up and maintaining facilities. Hence,

both of these factors were used as sub-criteria within the cost category, and should also be considered as generic parts of the model. While Robinson & Swink fail to assign importance to other, less cost-related, aspects of a distribution configuration, Lee & Tiede (2005) suggest that the main objective behind network configuration is to shift the cost-responsiveness frontier, thus improving service levels while lowering costs. Hence, a service related measurement was incorporated in the evaluation tool – value to customers. Chopra and Meindl provide further support in this selection, by stating that the appropriate distribution design is the one that satisfies the demands at the customer at the lowest possible costs (Chopra & Meindl, 2007). The authors suggest a large variety of evaluative factors for a distribution design such as macro economical, strategic, competitive, and political factors etcetera. These factors were not utilized in the evaluation model due to several reasons: some of these factors did not find support in interviews within the case company as to their importance in the specific context, the factors did not seem to be derived from an

objective function of some sort (What do we want to achieve?), and finally – when constructing a tool consisting of too many factors, the main picture might be blurred when factors of low importance are mixed with critical factors.

When moving from the evaluative criteria to the lower hierarchal elements, the model becomes less generic and more company specific. The evaluative criteria are broken down into several *Measurable Elements*, which for the case company were considered to be of a satisfactory level for investigation. Each element is connected to one or several *Drivers*, which are aspects on which the measurable elements are

investigated. The investigation can be either quantitative or qualitative in nature, depending on the character of the driver. The drivers are derived from semi-structured interviews in which the respondents were asked to name possible advantages and drawbacks with the suggested network design. Thereby, the objectives of the case company could be concluded, and the objects (drivers) that the evaluation tool needed to assess deducted. The drivers were categorized into measurable elements, in which the results from the drivers connected to the same can be aggregated. The categorization thereby simplifies the process of deriving a recommendation from the drivers.

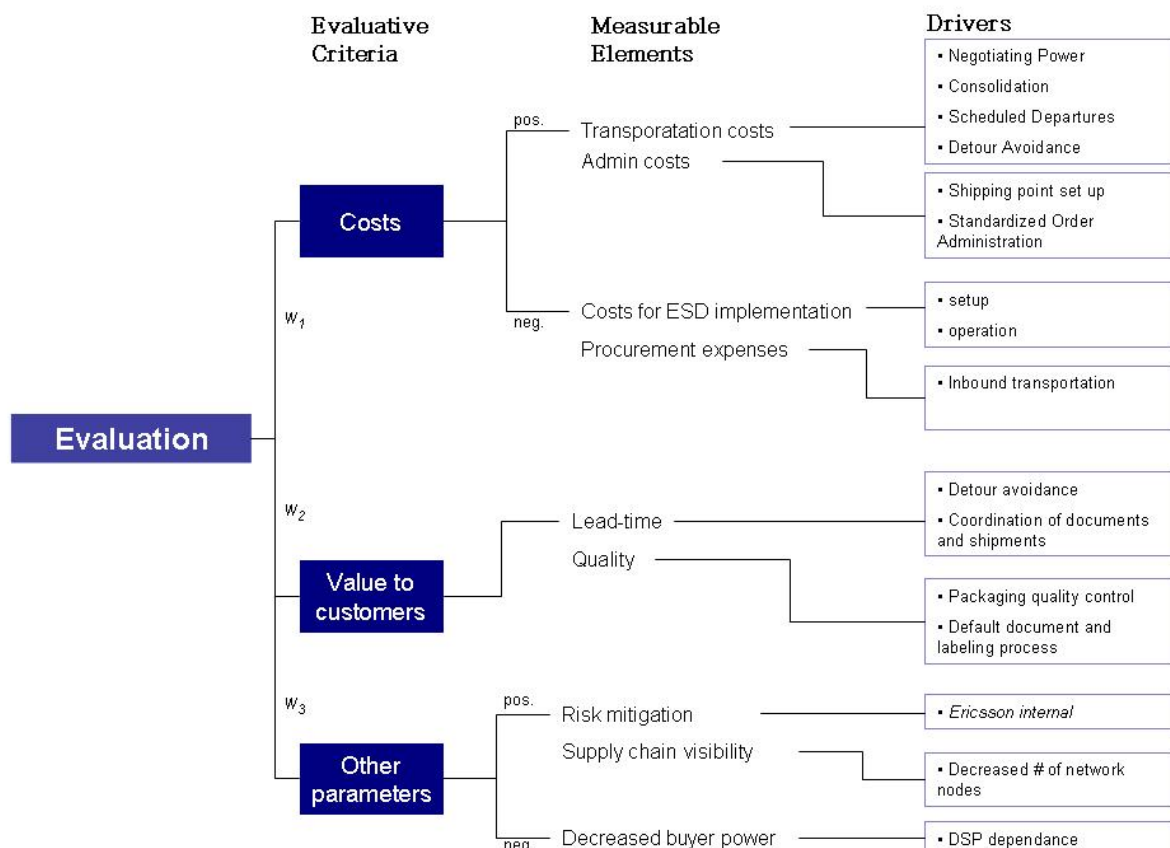
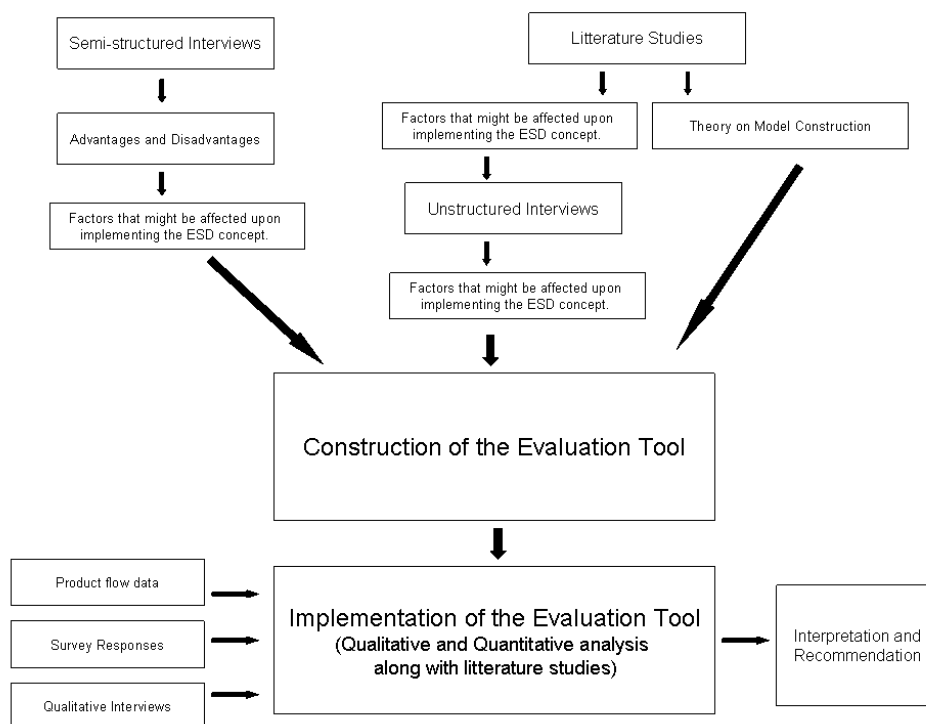


Figure 1 The evaluation tool for the ESD Concept.

### ***Procedure to develop the tool***

The main advantage with the evaluation tool described above is that it is derived from objectives and strategic choices of the specific company it aims to assess. The analytical hierarchy process was utilized in order to create the overall structure and this method was selected since it allows for

the model to incorporate subjective judgments along with empirical data (Korpela & Lehmusvaara, 1999). Below, the procedure used to develop and implement the evaluation tool on the case company is described in more detail, in order to provide the reader with knowledge on how to utilize this model in another context.



**Figure 2** The method used for developing and implementing the evaluation tool on the case company

Starting up, a series of 23 qualitative semi-structured interviews with key personnel<sup>1</sup> was carried out. The interviews functioned as to provide an understanding for the current situation, the objectives that the new network design was to fulfill along with potential advantages and drawbacks that could be expected upon implementing the suggested network. These interviews were conducted with persons within different

roles of the case company, and our aim was to create an understanding of the problem that incorporated various perspectives as seen from e.g. sourcing, trade, legal and distribution in order to enable an evaluation from a system approach perspective.

The potential advantages and drawbacks of the distribution network were interpreted in terms of factors that would be affected upon implementation of the system. These factors were complemented with factors

<sup>1</sup> Personnel that have an impact on, or are directly affected by, the new distribution set-up

found in literature. Some of the factors found in the literature were thereafter determined as irrelevant after having conducted unstructured interviews on the topic. The resulting factors were assigned the status of *drivers*, and arranged in measurable elements.

The tool was implemented by assigning the drivers values. In order to do so, flow data was used along with a survey and subjective judgments given by experienced personnel. Depending on which driver that was to be measured, different input and methods of analysis were used. The results on the drivers were aggregated into their measurable elements and thereafter into their respective evaluative criterion, from which the recommendation was derived.

The procedure described above can easily be applied in another organization, thereby creating a tool that has the overall structure of the evaluation tool described in this article, but with measurements that suits the specific organization.

### ***What are the advantages of the tool?***

So why should this tool be used instead of another? Some reasons are presented below in order to provide an answer to that question.

(1) many tools found in literature are mathematical in nature. Since a lot of the factors that are normally derived from interviews within a company can be expected to be non-quantifiable in nature, such an analysis might not be able to mimic reality in an adequate enough manner. Our claim is supported by Korpela & Lehmusvaara (1999) who suggests that there has been a recent trend to use other tools than purely mathematical, due to the

latter's insufficiency when addressing qualitative measures.

(2) creating an evaluation tool of this nature enables a network designer to address the factors that are of importance for a specific company. This argument is derived from Harrison & Van Hoeks' (2005) reasoning concerning how the nodes should be located in a distribution network, namely that each company needs to select relevant location criteria based on their specific needs. We thereby claim that each company needs to do so also when *evaluating* a distribution network.

(3) by structuring the factors of importance in an analytical hierarchy process, the usage of subjective judgments are enabled and can be made alongside quantitative analysis of empirical data. This hybrid characteristic is pointed out by Korpela & Lehmusvaara (1999) as one of the main advantages with the AH process. The subjective judgments can be used to assign the qualitative factors their value, along with quantitative factors for which the data is considered insufficient. By utilizing subjective judgments a network designer can strive to include some of the tacit knowledge that personnel within the organization possesses into the analysis. (Including such knowledge is a rather delicate task, since there is a risk that personal agendas, misinterpretations etcetera get to influence the analysis. In order to avoid such effects, subjective judgments could for example be collected from a variety of personnel within different parts of the organization.)

(4) In order for the recommendation to be of value to an organization we believe that the underlying rationale and evaluation procedure needs to be clear. If the evaluation does not exclude factors that are of low importance, the factors will be numerous, and the model will be harder to

communicate within the organization. If the analysis cannot be communicated properly, one cannot expect that an organization will use the resulting recommendation as a base for decisions. This is why for examples balanced scorecards might come out short compared to this evaluation tool. Also by prioritizing factors of high importance, the recommendation can be clearly derived, and the risk for sub-optimization is not as large as if all possible factors would be included.

### **References**

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