Complexity management and management of assortment variety in particular are the subject matter of many strategic decisions in consumer goods industries. As the assortment of a company evolves continuously by introducing new or discontinuing existing product variants, the important question is “What effects on the configuration of the production and distribution network and related costs can be expected if the assortment is changed in a particular way?”. This work presents an approach to a decision support system that models assortments together with their production and distribution structures and optimises a set of assortment-dependent parameters to adapt the production and distribution system to a certain assortment. Two mathematical optimisation models are formulated to decide about the allocation of inventories within the network and determine several production execution related parameters. Given the application of the optimisation methods to both a baseline model and alternative assortment scenarios, a comparative cost analysis can be carried out to assess the effects of changing assortment complexity. The main advantage of this scenario-based approach is that effects can be assessed more precisely due to the previous adaptation to the new assortment. The optimised models provide decision-relevant information both about the expected cost effects as well as about the required changes in the configuration of the production and distribution network. The developed methods are implemented in a prototype decision support system (DSS) and validated in a real-world scenario by analysing potential assortment changes for the case of an international consumer goods manufacturer.