

# Improving assessment of robustness and reliability of mechanical systems from concept design



Vinicius Kaster Marini  
Ph. D. student - vkm@mek.dtu.dk  
Nils Koppels Allé, 404 - DK-2800 - Kgs. Lyngby - Tel.: +45 5052 4919

## Problem statement

To be reliable, a system must be robust, avoiding failure modes in a variety of working conditions (Clausing and Frey, 2005). Current design methods can only play a major role in product design once it has been developed to a certain level, because of the detailed information they consider.

However, late acknowledgement of design weaknesses may lead to expensive engineering changes (Eckert et al., 2004), following up to undesired cost increases and deadline breaks (Williams et al., 1995). On the other hand, although changes are intended to solve weaknesses in product designs, assessing their impacts can be a complex procedure (Keller et al., 2007).

The ability to carry out assessments earlier in the design process shall improve the influence of design methods in better preventing problems in product designs.

## Aims of research

The main objective of this project is stated as follows: "To provide a set of procedures for recognizing influencing factors to failure modes in the concept design of mechanical systems, thus anticipating the assessment of robustness and reliability".

Therefore, its attainment involves finding out answers to the following research questions:

- How can robustness and reliability be assessed from concept design?
- How may robustness and reliability be affected by engineering change?

## Approach

Definition of criteria: (Pilot case)

- Literature review: to be performed to get a grasp on the current knowledge in the research context;
- Product decomposition and scenario-making: to be carried out with the purpose of understanding the criteria for developing the subject;

Descriptive study I:

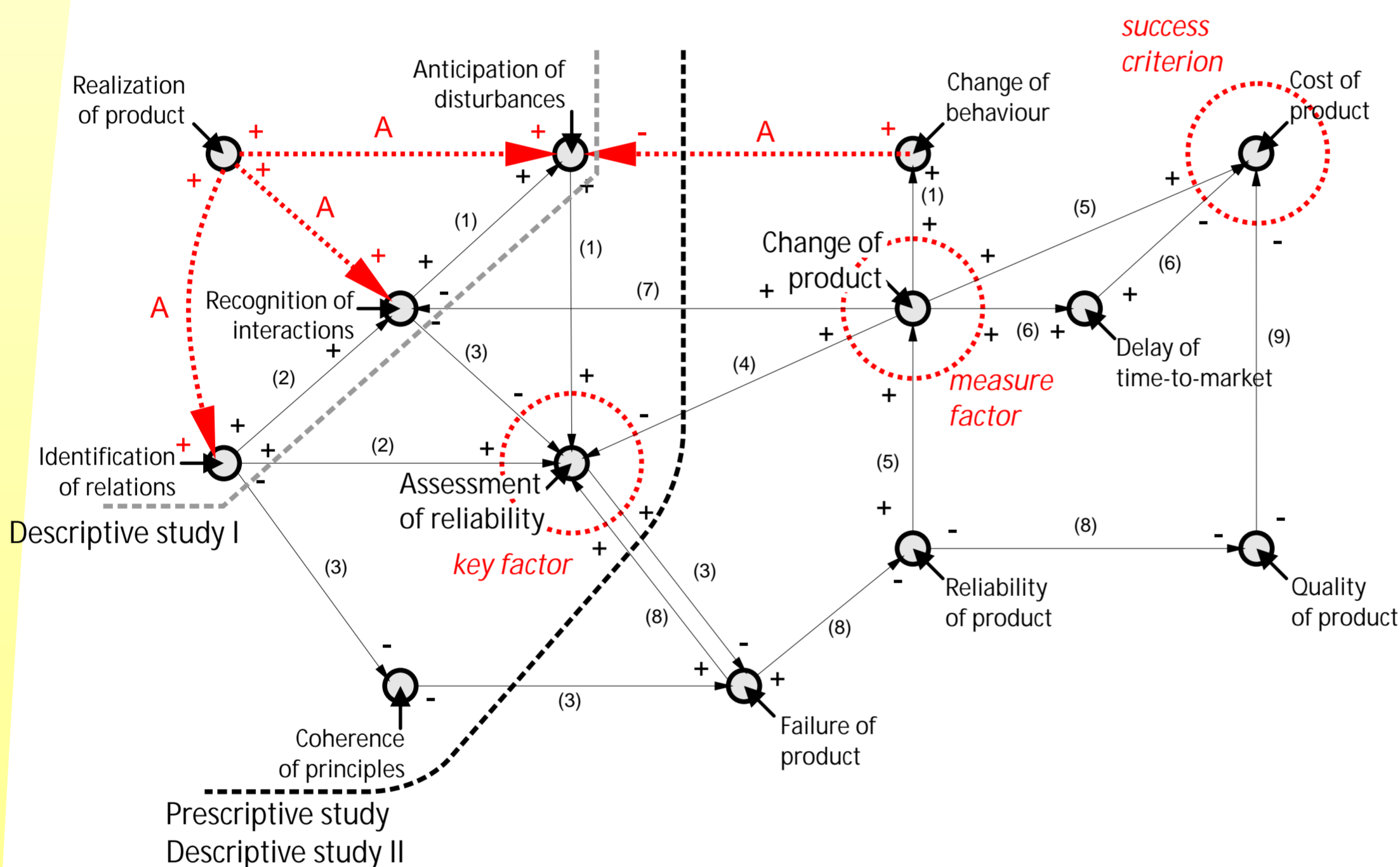
- Interviews: to be executed in order to describe how designers are currently able to bring issues;
- Document analyses: to be carried out with the purpose of bringing evidence on relationships between issues pointed out by designers;

Prescriptive study:

- Literature review: to understand how current knowledge can be associated in order to provide support for the matter under investigation;
- Information modelling: to be made out of searching for appropriate ways to connect useful information according to findings;

Descriptive study II:

- Validation interviews: to be performed in order to verify the suitability of the propositions to practice.



## Expected results

A design strategy including robustness and reliability criteria in concept design:

It shall incorporate the knowledge attained throughout the research in helping designers to consider reliability and robustness by the concept design stage.

Such set of guidelines within a design method aims to provide support to developing more robust working principles, to improve the fitness of the final product design.

A model to anticipate effects of change on robustness and reliability:

Though the information on the product is ill-defined to a certain extent on the concept level, assessing change impacts is to be simpler, faster and would have further influence into product costs.

Such would be assured by a strategy which considers conceptual designs and their information as basis for scenario making.

