

An approach to identifying the ideal time to perform an FMEA during the product development process



TECHNISCHE UNIVERSITÄT DARMSTADT

SFB 805



Beherrschung von Unsicherheit in lasttragenden Systemen des Maschinenbaus

founded by:



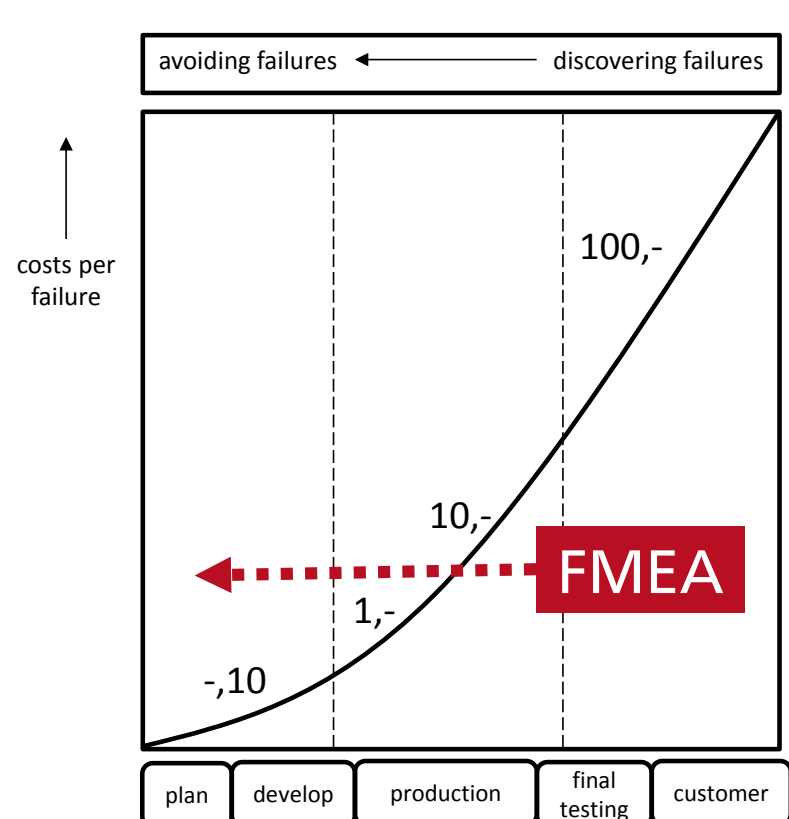
Württemberg Jan, Kloberdanz Hermann • product development and machine elements pmd



Motivation

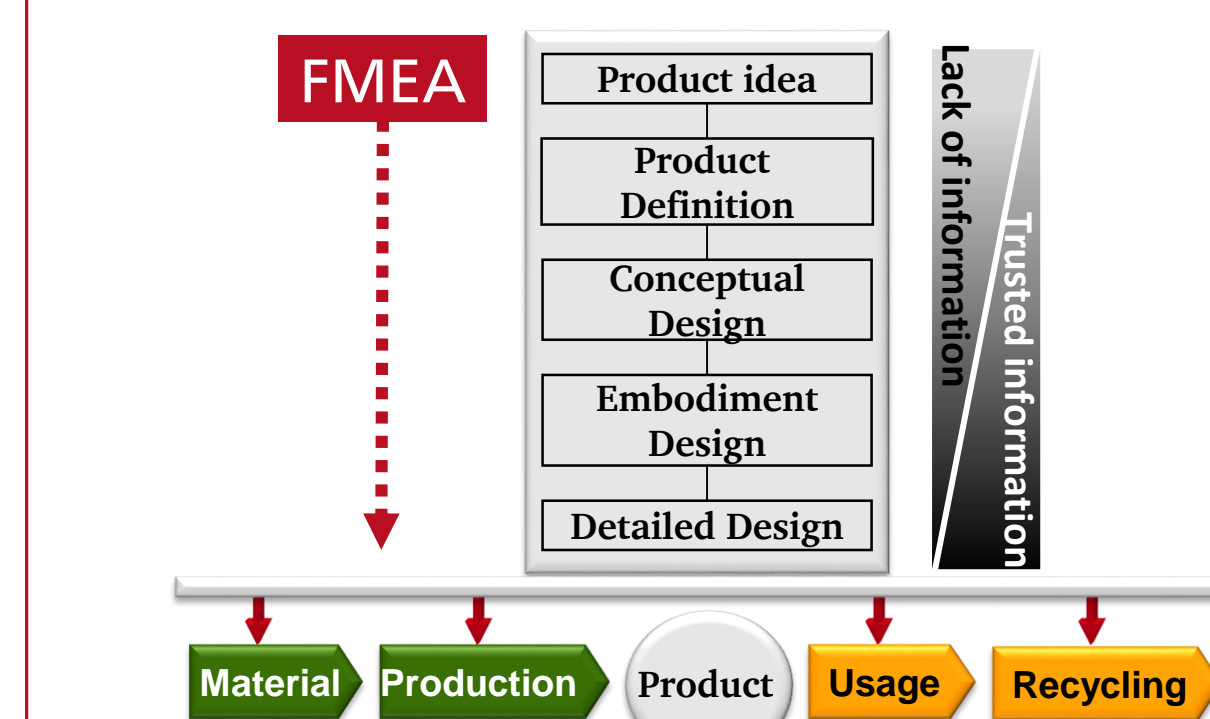
The literature contains varying recommendations on the best time to perform an FMEA.

Cost per failure



The earlier a failure is identified, the lower the resulting costs of rectifying it.

Level of information

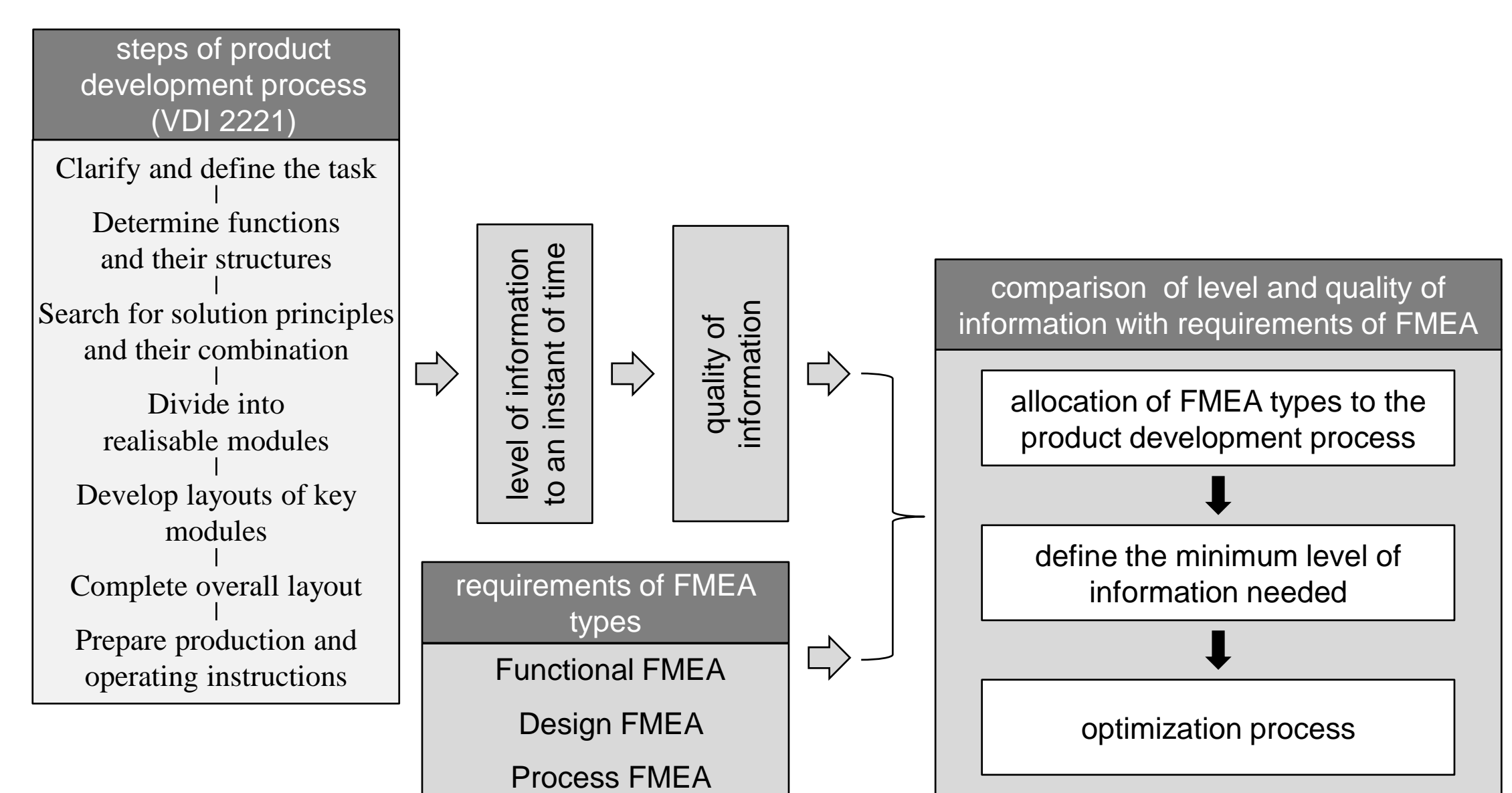


The later a FMEA is performed, the better the level of information and the benefit of the results.

Approach

The conflicting parameters costs per failure, level of information and quality of information are analysed.

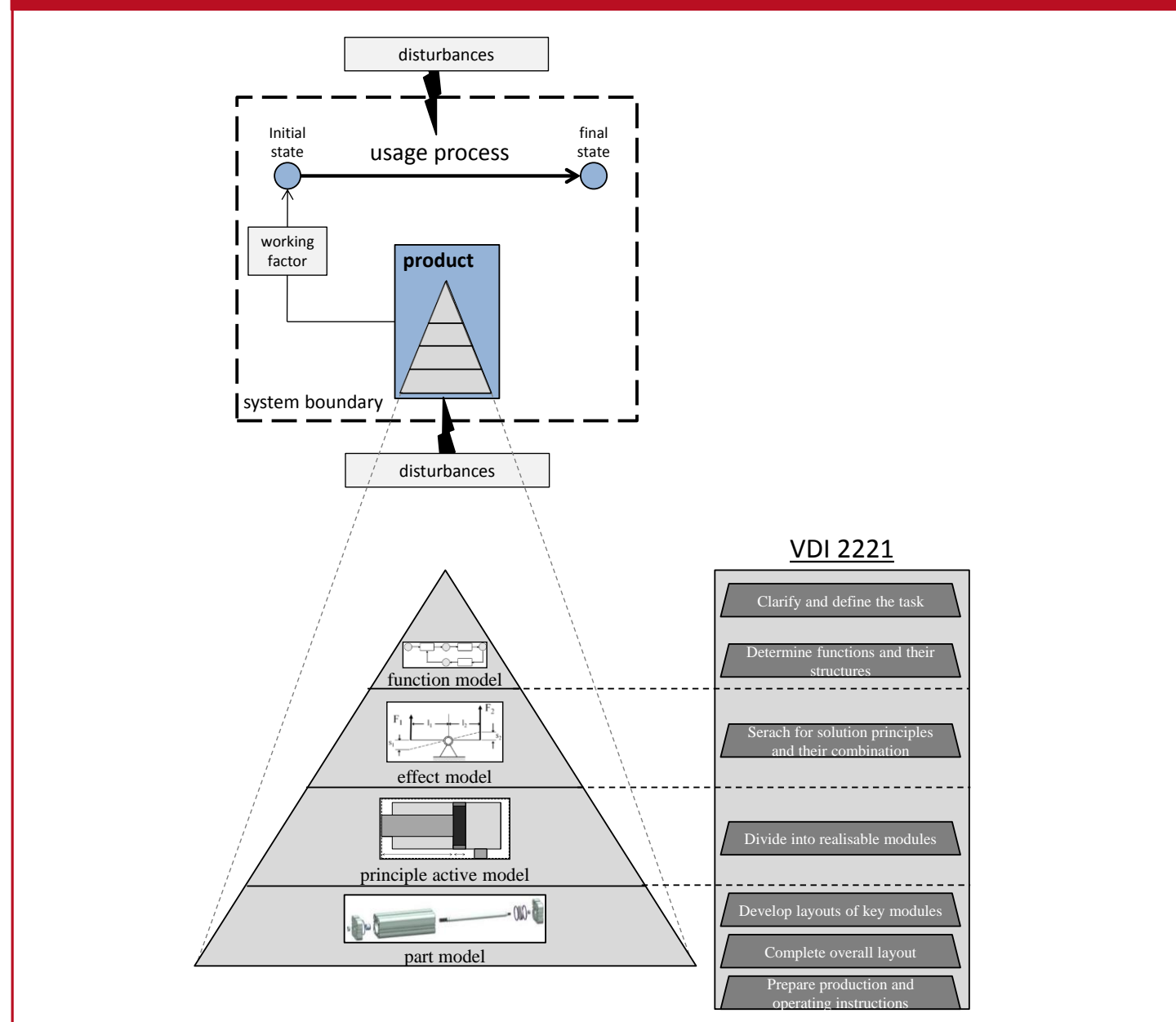
Working steps to identify the ideal point of time to perform a FMEA



Method for identifying an ideal time to perform an FMEA

The level of information is systematized to an instant of time by using product and process models. First, the systematized level of information is evaluated using the *Information Quality Framework*. Second, the level and quality of information is compared with the performance requirements of an FMEA. With this help, it is possible to allocate FMEA types to the steps of product development of VDI 2221. Final, trends of the dimensions, such as the costs per failure, are optimized, limiting the possible range of performing the FMEA type.

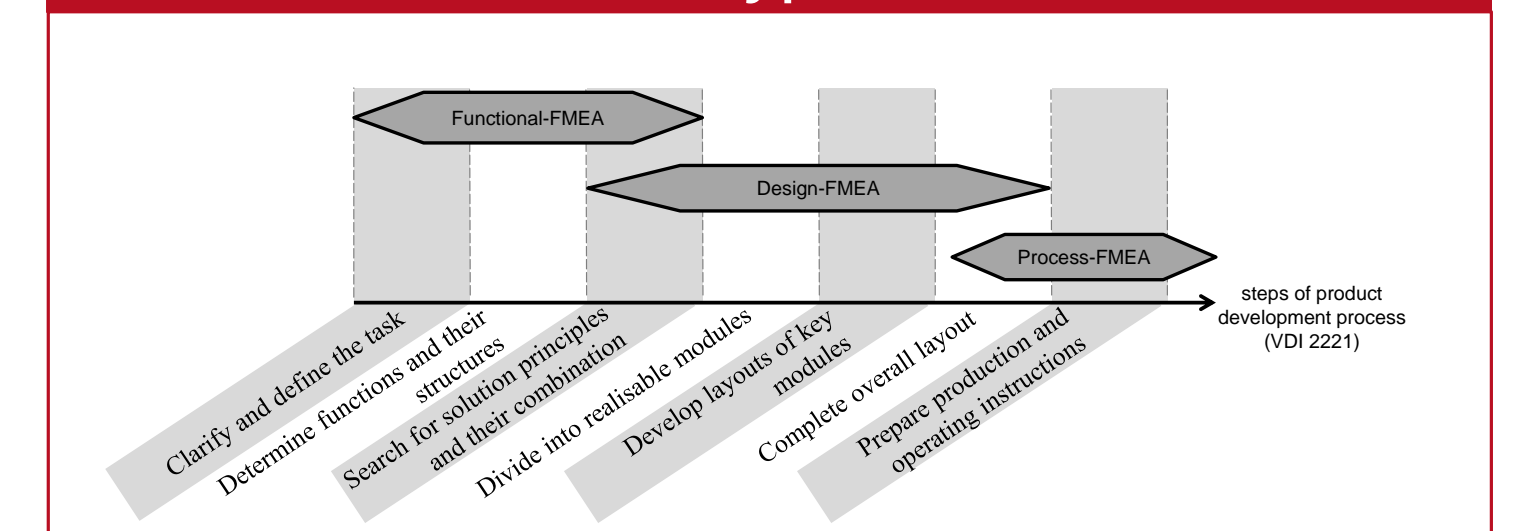
Level of information



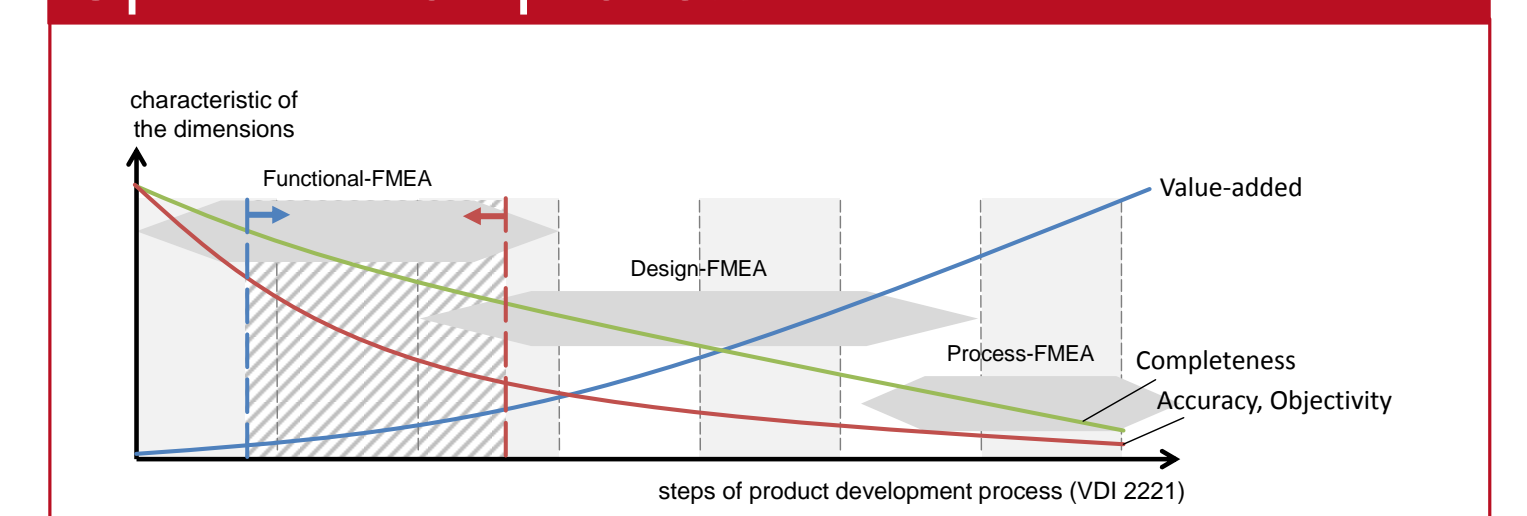
Quality of information

VDI 2221	level of information		quality of information												
	product	process	Intrinsic	Contextual	Objectivity	Completeness									
clarify and define the task	information model	process	function fail	wrong effects are chosen	parameter of the effects	conflicting parameters because of the chosen effects	very high	very high	very high	low					
determine functions and their structures	function model	effect model	physical, biological or chemical effects	parameter of the effects	equations of the effects	dependencies between effects	medium	medium	high	medium					
search for solution principles and their combination	effect model	effect model	radius of action	geometric of bodies	motions of the bodies	active areas of the bodies	wrong dimensioning of the bodies	friction, wear	low	low	medium	high			
divide into realisable modules	effect model	effect model	material properties	geometric properties	production methods	design principles	temperature	composition	environmental influences	human influence	unintended effects	very low	very low	low	very high
develop layouts of key modules	part model	part model	assembly instructions												
complete overall layout															
prepare production and operating instructions															

Allocation of FMEA types



Optimization process



Evaluation of the approach

A pneumatic cylinder is used to evaluate the approach, which has to fulfill the use process *lift a load*. The level of information during the product development process is illustrated using completed product models. The identified trends of the dimensions out of the *Information Quality Framework* can be confirmed.

Level of information

VDI 2221	level of information
clarify and define the task	CONDUCT
determine functions and their structures	CONDUCT
search for solution principles and their combination	CONDUCT
divide into realisable modules	CONDUCT
develop layouts of key modules	CONDUCT
complete overall layout	CONDUCT
prepare production and operating instructions	CONDUCT

Conclusions and outlook

The results demonstrate dependencies between the level of information, the quality of information using the *Information Quality Framework* and the requirements of the FMEA. With this help, trends of the dimensions are identified, which are used to optimize the point in time to perform an FMEA. This is an important contribution to making product more robust:

- Failures are analysed at the right time.
- Designers have to think about the available level and quality of information used to perform an FMEA.
- The product itself is analysed before the FMEA starts.

Identified dependencies

