SUCCESS FACTORS OF QFD PROJECTS

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Abstract

Not every project based on QFD leads to the desired success. This paper describes the results of a multi-firm benchmarking study. Comparing 16 successful and unsuccessful projects, conclusions can be drawn about the relevant success factors of QFD projects.

Contents

1 Subject and methodical concept

Not every QFD project leads to the desired success (Curtius, B., 1995, 402). Essentially, the reason for this is to be searched in the flexibility inherent in QFD. QFD can and must be adapted to the respective application situation; there is no standardized applicable method for all possible areas of employment (Herzwurm, G., Schockert, S. and Mellis, W., 1997, 183). Instead the design of the QFD process must take place with regard to the specifically existing, for the short term not influenceable situation and the relevant objectives (Kubicek, H. 1975, 15-33). That raises the question which factors positively or negatively affect project success. This work would like to offer an established concept with whose assistance the possible design parameters of a QFD project can be analyzed regarding its effects on project success (see Ahlemeier, G. and Herzwurm, G., 1998 for details; see Griffin, A., 1992 and Hunt, R. B., 1997 for comparable studies).

In accordance with the decision-theoretical model a decision problem like the design of a QFD project consists of the following components (Eisenführ, F. and Weber, M., 1994; Kubicek, H., 1975, 15-23):

- *Design goals* steer the entire process of the design and take therefore a central position. In the decision-theoretical model that design alternative is selected which offers the highest contribution to the realization of the business goals. Moreover, design goals support the evaluation of different alternative actions.
- *Design conditions* form the situation of the designer resp. decision-maker (decision field). In the given field of consideration they represent not influenceable restrictions which on the one hand make demands on the alternative actions to be taken and which on the other hand have an influence on the effects of these actions. Therefore they are also called *design restrictions*.
- *Design parameters* represent the possible alternative actions with which the pursued design goals should be achieved. The essential thing here is to align the behaviour of the persons concerned in a given situation to certain goals. By the selection of design parameters design actions are defined.
- *Design effects* describe the prognosticated and/or actual behaviour of persons concerned which finally lead to the desired degree of goal achievement.

In the following a heuristic cause-effects-model is developed which shows expected effects of the at short notice influenceable design parameters on project success. This model is then tested in a study of the QFD employment in operational practice.

2 Concept for the determination of the success factors of QFD projects

2.1 Goals of the QFD employment

Success means to reach the given goals. Accordingly, a justified selection and evaluation of design alternatives are only possible if the objectives are explicitly defined. Besides, the selection and evaluation of the possible design alternatives vary with the pursued objectives (Schmelzer, H. J., 1992, 44).

The objectives which the evaluation of the alternative actions are based on should be operational, i.e. in particular a clear and appropriate item to destine the goal must exist (Omagbemi, R., 1994, 32-33).

Additionally, the effects of the selected alternative course of action on the objective must be detectable (Frese, E., 1995, 261-262). Particularly, the latter condition leads to a clarification of the relevant goals of a product development project on product (see figure 2-1) and on project level (see figure 2-2) (Schmelzer, H. J., 1992, 45).

Different goals are not always complementary or neutrally to each other. Sometimes they even compete with one another. Such conflicts have to be solved in the respective application situation as a function of the pursued business goals (e.g. by their weighting).

Goal group			Goal	Item to destine the goal
Goals on product level	Market entrance date	Short development time	Snaps introduction on the market	Time interval start of development and introduction on the market in days
	Product cost/ price	Low costs	Costs of failure	Costs of error correction and redesign before the distribution in $
			Economical production	Manufacturing costs in $
		High attainable absolute price	High selling price	Selling price price in $
		Accepted one relative price	Price expectations of the customers appropriate paragraph price	Customer satisfaction with price
			Cost-performance ratio expectations of the customers appropriate products	Customer satisfaction with cost-performance ratio
		High product result	High product amount covered	Product amount covered in $
	Product quality	High technical quality	The technical specification appropriate products	Number after the distribution of found deviations from the specification
		High relative quality	Achievement expectations of the customers appropriate products	Customer satisfaction with achievement
			Competitive products	Product bench mark (customer satisfaction index comparison)
			Innovative products	Number of new characteristics in piece

Figure 2-1 Goals on product level

Goal group				Goal	Item to destine the goal
Goals on project level	Project dates / -cost	High economy	Acceleration of the product planning		The product development takes place within a short time.
					Several product components can be developed parallel.
			Re-use of development results		Results of earlier developments are systematically reused.
			Focusing on the substantial		The concentration on the substantial instead of a waste with the unimportant takes place.
	Project quality	Adequate methodo-logy	Systematic structured proceeding		The proceeding during the product development is systematic and structured.
			Constantness up to the delivery into production		The development takes place constantly from the customer requirements to the delivery into production.
			Objective product decisions		All product decisions are made according to objective criteria.
			Comprehensibleness		The entire product development process including the made decisions is comprehensible.
			Authentication for product decisions		The documentation of the development serves for the authentication of product decisions.
			Adaptability at customer expectation changes		The development is adapted flexibly to changed customer expectations.
		Comple-te infor-mation	Information about customer requirements	Collection of the real customer requirements	The real customer requirements are seized.
				Prioritization of the customer requirements	The importance of the customer requirements becomes clear.
			Examinable defaults for product characteristics	Concrete defaults for product characteristics	Concrete defaults for individual product characteristics are developed.
				Test criteria for product characteristics	Operational test criteria for individual product characteristics are developed.
				Evaluation of product ideas	Product ideas are examined into their suitability.
			Basis for prognoses	Management of risks	Risks are promptly recognized and treated.
				Adherence to planned development times	Given development times are kept.
				Foresighted acting	The forecast of certain consequences of product decisions is possible.
			Integration of all know-how carriers		All persons with know-how over the tasks which can be worked on are involved into the process.
			Consideration of the enterprise-external surrounding field	Competitors	The competitors are considered with the development.
				Suppliers	The external suppliers are considered at the development.
				Customers	The customers are considered at the development.
		Good co-operation	Department-internally	Function to co-operation	The co-operation of the co-workers of the range works well.
				Improvement condition and behavior of the employees	Positive attitude, motivation, role understanding, ability and suitable behavior of the co-workers are promoted.
			Department-spreading	Tuning of the department goals and - decisions	Goals and decisions of the departments involved are co-ordinated.
				Common view on the product	All departments involved possess a common view on the product.
				Smooth information flow	A smooth information flow between the departments involved takes place.
				Knowledge transfer to other ranges	The knowledge transfer between the departments, necessary for the development, takes place.
				Mutual understanding	Requirements and problems of the department taken part in each case are transparent.

Figure 2-2 Goals on project level

2.2 Design conditions and design parameters as determinants of project success

The possible determinants of project success can - independently of how they affect the degree of the goal achievement in the different phases of the project - be grouped as follows (Specht, G. and Schmelzer, H. J., 1991, 8):

$Z_P = f(U, G, M, B, P)$,

with Z_P = degree of achievement of the design goals

U = characteristics of the enterprise

G = characteristics of the developed product

M = characteristics of the humans who participate in the project or affect it´s process and the relations between these humans

B = characteristics of the product development department

P = characteristics of the QFD projects

and f the effect of all determinants on the achievement of the design goals and thus on project success (in the following also called QFD efficiency).

Both the determinants of project success and the goals described in chapter 2.1 do not only have validity for QFD projects. The systematization used in this paper can be put likewise to product development projects which use another instrument. For this reason instead of QFD the generalized term "instrument" is used. Corresponding to the equation above the model for the collection of the determinants of project success outlined in figure 2-3 can be put as a basis to the following expositions.

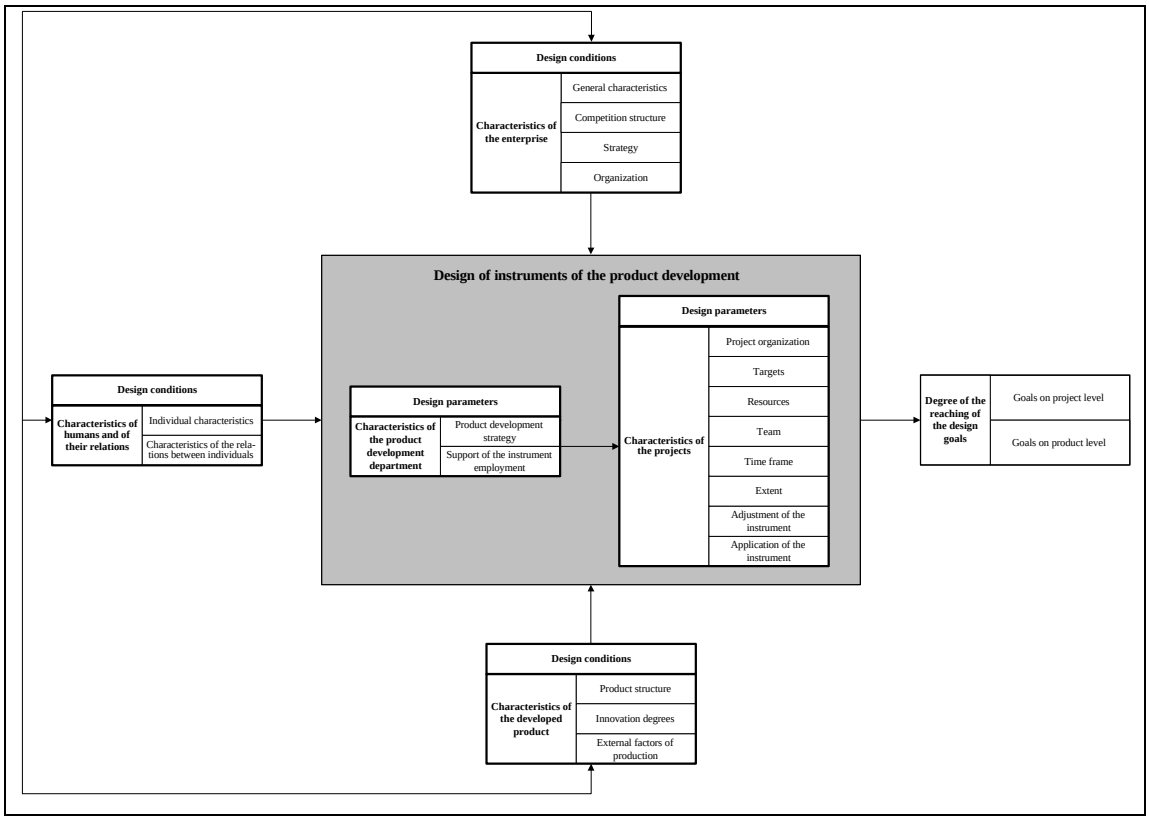

Figure 2-3 Model for the collection of the determinants of project success

According to the criterion of the short-term influenceableness in the context of the project design the determined determinants are to separate into design conditions and design parameters. At first design conditions are the characteristics of the enterprise. Since thinking and behaviour of the persons taken part in a project can be in principle affected only on a long-term basis, also their characteristics must be considered as given design restrictions. If one refrains from the concrete arrangement of a product on basis of the customer requirements, then finally the characteristics of the developed product are restrictions for the design of a QFD project. Regarding the design of a product development project the decision makers are usually the high-level personnel and employees of the product development department. Therefore its characteristics can be regarded just like the project characteristics as influenceable design parameters.

2.3 Cause-effects-model for the execution of QFD projects

2.3.1 Selection of design parameters for the implementation of the design goals

The cause-effects-model is formulated in the form of theses over the effects of design parameters on certain objectives. To do this each group of design parameters is investigated regarding its positive effects on the goals on project level and on the goals on product level. Figure 2-4 shows the design effects which are subject to the model.

Legend:
Pn — Number of the thesis to the connection between design parameters and an design goal

Design goals		***Design parameters***	**Characte-ristics of the product develop-ment department**		**Characteristics of the projects**							
			Product development strategy	Support of the instrument employment	Project design	Targets	Resources	Team	Time frame	Extent	Adjustment of the instrument	Application of the instrument
Goals on project level	Economy		P1		P3				P7			P13
	Methodology			P2								P10, P12
	Information					P4	P5			P8, P14	P9	P11, P14
	Co-operation							P6				
Goals on product level	Market entrance date			P2	P3	P4	P5		P7			
	Product cost/price							P6				
	Product quality		P1							P8, P14	P9	P10-P13, P15

Figure 2-4 In theses formulated cause-effects-model for the execution of QFD projects

2.3.2 Theses for the design of the product development department

Thesis P1: A product development strategy which is based on innovation and/or quality responsibility of all employees improves the economy of the product development and increases the product quality.

Thesis P2: An efficient support of the instruments employment by the product development department in form of sufficient management commitment, an integration of the instrument into the product development processes, and an employee-fair introduction of the instrument leads to an improved utilization of the methods potential and shortens the development time.

2.3.3 Theses for the design of QFD projects

Thesis P3: A structured project organization increases the economy of the product planning and shortens the development time.

Thesis P4: A clearly defined objective promotes the identification of all information important for the product development and shortens the development time.

Thesis P5: Project resources which are available in sufficient quantity make the determination of all information important for the product development possible and shorten the development time.

Thesis P6: A cross-functional project team promotes co-operation during the product development and leads to lower product cost/prices.

Thesis P7: Well prepared and temporally tautly dimensioned team meetings increase the economy of the product development and shorten the development time.

Thesis P8: A with regard to volumes, dimensions and depth comprehensive planning during the product development increases the completeness of the information necessary for production and leads to a higher product quality.

Thesis P9: The adjustment of the instruments to project-specific conditions increases the completeness of the information necessary for production and leads to a higher product quality.

Thesis P10: Following the basic principles and techniques of the instrument leads to an adequate methodical proceeding during the product development and increases the product quality.

Thesis P11: The intensive questioning of the customer is a condition for the acquisition of the information necessary to satisfy the customers needs and thus for the achievement of a high relative quality.

Thesis P12: A stringent separation between (customer) needs and (technical) solutions in the analysis of customer questioning results supports a methodical proceeding and lowers the risk of developing not suitable product features leading to decreased relative quality.

Thesis P13: A founded analysis of the connection between customer needs and product characteristics increases the economy of the product development and reduces the risk to develop redundant and/or not to the technical specification corresponding product features.

Thesis P14: A sufficiently detailed planning secures the information necessary for the production of the specification and increases the technical quality of the product.

Thesis P15: A differentiation between the needs of different market segments when producing for a whole market and/or a differentiation between the needs of different customer groups when

producing for a dedicated customer leads to an adequate consideration of the business environment as well as to other necessary information and increases the relative quality of the product.

The made selection of the connections formulated in the theses results from numerous existing empirical studies about product development. The lacking transferability of most results prevents one from directly using the empirical findings as proof for the truth content of the theses set up. They can, however, serve as the reason for the made assumptions and thus for the reduction of the arbitrariness of the selection.

2.3.4 Success factor analysis on the basis of the cause-effects-model

With the cause-effects-model clear, principally refutable theses are formulated. These theses subordinate a causal connection between certain design actions and the degree of the achievement of certain design goals. The existence of this connection has to be examined in an empirical investigation (Bortz, J., 1984). To do this one has to raise the specific characteristics and goals addressed in the theses in carried out QFD projects.

3 Testing the concept in a QFD field study

For the execution of the following investigation QFD users, mainly project manager, from ten different enterprises could be won (see table 3-1).

Enterprise	Branch of the regarded business field	Number of employees in the enterprise	Number of employees within the examined product development department	Field of the asked employee
Applicon GmbH	Software branch	200	60	Marketing
Boehringer Mannheim GmbH	Chemistry branch	18,000	7,000	Project management
Hewlett Packard GmbH	Electronics and electro technology branch	100,000	80	Procurement
Mannesmann Mobilfunk GmbH	Telecommunica-tions branch (here: Software components)	3,000	400	Quality department
Robert Bosch GmbH	Telecommunica-tions branch	160,000	No indication	Quality department
SAP AG	Software branch	12,000	5,000	Quality department
Siemens AG	Telecommunica-tions branch (here: Software components)	370,000	No indication	Project management
Sporthalle Oberwerth GmbH	Entertainment branch	9	3	Management
Unisys AG	Software branch	60,000	3,000	Project management
Volkswagen AG	Motoring industry	10,500	6,000	Quality department

Table 3-1 Characteristics of the enterprises taken part in the field study

The probands were asked - apart from the unique (written) answer of questions for the collection of project-independent design conditions - to fill out a separate questionnaire for each completed QFD project they select. In these questionnaires they state the project-specific design goals made by them and the design determinants. In this way 16 QFD projects could be included in the investigation.

The success of each project examined was first asked on the basis of the absolute and relative total success of the project. Additionally - to destine the degree of achievement each design goal - an absolute (subjective) estimate of the satisfaction with the goal achievement was asked for. In order to achieve this, positive statements were formulated for the items to destine each goal to which the persons asked should indicate their degree of agreement in five gradations (from complete refusal to complete agreement) if the

statement (the pursuit of the goal) for the examined project is relevant (see for customer satisfaction surveys Hayes, B. E., 1992).

The structure of the questionnaire is shown in table 3-2:

Questionnaire for the collection of general enterprise characteristics	**Questionnaire for the collection of the success factors of QFD projects**
A. Data on the enterprise	A. Evaluation of the total success of the project
B. Data on the product development	B. Importance of the goals
	C. Evaluation of the satisfaction
	D. Data on the product
	E. Data on the project
	F. Data on the team

Table 3-2 Structure of the questionnaire

On the basis of the satisfaction evaluation for each project a developer satisfaction index was determined (methodically similar to the computation of a so-called customer satisfaction index) which shows the total satisfaction of the persons asked with the achievement of the design goals (see Herzwurm, G., Schockert, S. and Mellis, W., 1997, 104-105, 225 for details).

Developer satisfaction index to project j concerning a design goal i for importance W and satisfaction Z

$$= \sum_{i=1}^{I} (W_{ij} * Z_{ij}).$$

In fact this proceeding causes the danger of false estimates on the part of the persons asked. However, the data situation of the enterprises involved allows no economically acceptable alternative of success measurement of the QFD employment.

Additionally to the developer satisfaction indices satisfaction profiles were provided for each raised characteristic. On the basis of these profiles the effects of different characteristic values on the achievement of the design goals was examined. Due to space reasons in this article only some few goal profiles are represented.

4 Results of the QFD field study

4.1 Achievement degrees of the design goals

The answers of the persons asked confirm that QFD fulfills the special expectation which is connected with the employment of the instrument in product development. Concerning the customer-oriented objectives technical and relative quality the employment of QFD achieves very high satisfaction values. From the project-related goals point of view QFD improves in particular the co-operation of the persons involved and leads due to focusing on the substantial at the same time to a higher economy of the product

development.

Figure 4-1 shows the achievement degree of the design goals at the lowest goal group level.

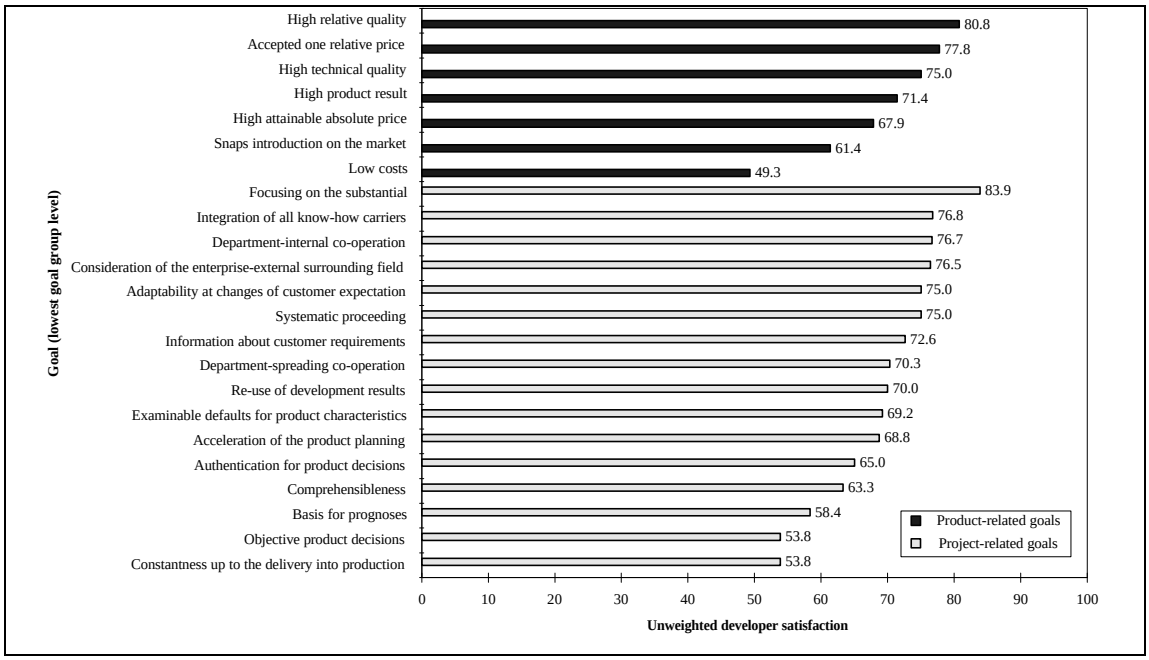

Figure 4-1 Satisfaction of the persons asked concerning the design goals (n = 16)

In order to retain an overall view in the multiplicity of the design goals, the following evaluations are based on an aggregated view of the goal groups.

4.2 Effects of the design determinants on the design goals

4.2.1 Effects of the design conditions

Effects of the characteristics of the enterprise

The results of the investigation let assume that the QFD employment is promising in large enterprises - which in particular see themselves suspended to a hard competition - because enterprises with these characteristics obtain without exception higher developer satisfaction indices than others. On the other hand, the branch does not seem to play an important role for the efficiency of QFD. Although QFD in the literature is classified as a primarily customer-oriented instrument, the two enterprises with the business field strategy costs leadership obtain even higher developer satisfaction indices than the eight enterprises with the quality leadership strategy. A remarkable phenomenon from the organizational designers point of view are the clearly better results of enterprises in which the quality department possesses at the most consulting or information powers in relation to such enterprises whose quality department is equipped with decision authority. Likewise concerning the QFD efficiency a concentration of the tasks of product development in the production department seems to be a solution which can be preferred in relation to the establishment of such tasks in the trading area.

Effects of the characteristics of the developed product

The developer satisfaction indices for software and non-software developments show only slight differences. A high product complexity does not seem to reduce the value of QFD. A slightly lower developer satisfaction index only results from a high necessity of explication of product characteristics to the customer. On the other hand a high innovation degree of the developed product seems to be a promoting factor for a QFD project. Besides, the efficiency of QFD is higher when producing customer individual products than products for the anonymous market. However, the developer satisfaction sinks, if the customer has extensive authority to influence the ongoing product development.

Effects of the characteristics of humans and of their relations

All projects in which the employees involved have positive attitudes, high motivation, clear role understanding, sufficient abilities and/or purposeful behaviour, run obviously more successful than projects where this is not the case. Similar statements can be found for smooth communication and co-operation in the team. Figure 4-2 shows in which way e. g. a positive attitude of the employees towards the customers affects the unweighted developer satisfaction concerning individual design goals. It becomes clear that customer-friendly attitudes rise the developer satisfaction index not only overall but moreover lead to a comparatively high satisfaction regarding all individual design goals.

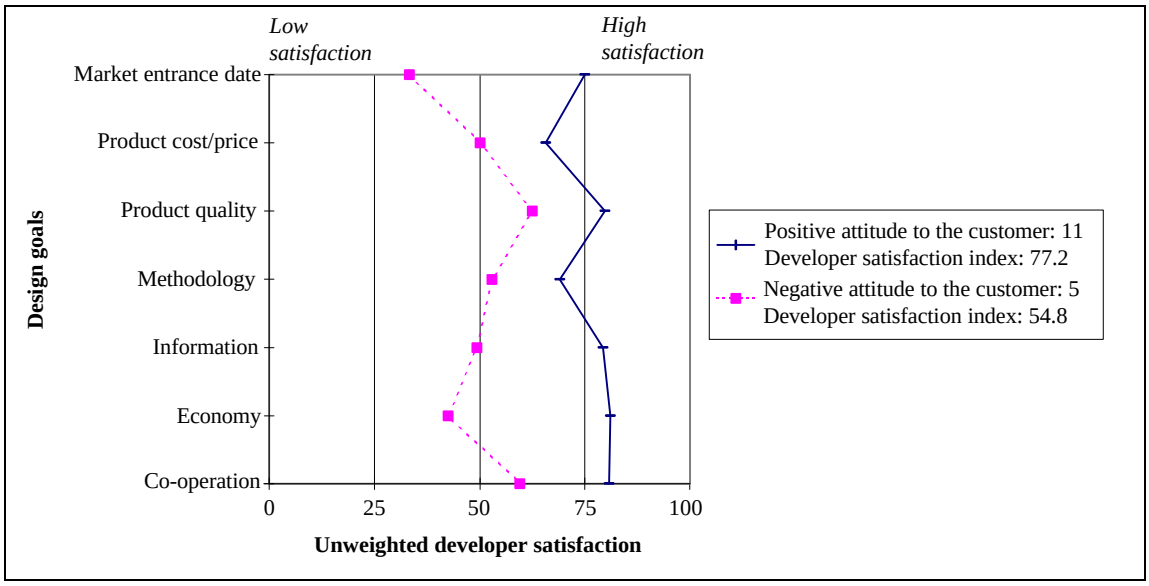

Figure 4-2 Values of the characteristic attitude towards customers and their effects on the developer satisfaction with the design goals (n = 16)

4.2.2 Effects of the design parameters

Effects of the characteristics of the product development department

Figure 4-3 shows that significant differences between QFD projects with high and with low developer satisfaction index are to be noted particularly in the product development strategy and the kind of the QFD introduction.

Project-independent design parameters					
Group of characteristics			**Characteristic**	**Frequency of characteristic value and height of the developer satisfaction index**	
Characte-ristics of the product develop-ment department	Product development strategy	Innovation strategy		Market entrance as successors: 2 Developer satisfaction index: 52.9	Market entrance as a pioneer: 8 Developer satisfaction index: 76.9
		Quality strategy		Particulars secure quality: 6 Developer satisfaction index: 67.1	All secure quality: 4 Developer satisfaction index: 79.5
	Support of the instrument employment	Management commitment	Promotion of the employment	Small promotion: 8 Developer satisfaction index: 75.7	High promotion: 2 Developer satisfaction index: 71.2
			Participation in the employment	No or passive participation: 5 Developer satisfaction index: 75.6	Active participation: 5 Developer satisfaction index: 68.5
		Integration instrument into product development processes		Does not integrate: 3 Developer satisfaction index: 72.1	Integrates: 7 Developer satisfaction index: 72.0
		Experiences with instrument		Time of introduction < 5 years: 4 Developer satisfaction index: 75.2	Time of introduction > = 5 years: 6 Developer satisfaction index: 70.0
		Kind of the introduction of the instrument	Introduction strategy	Top down: 3 Developer satisfaction index: 58.4	Bottom up: 7 Developer satisfaction index: 77.9
				Pilot project: 6 Developer satisfaction index: 76.0	Regulary project: 4 Developer satisfaction index: 66.2
			Training	Training course duration < 2 days: 3 Developer satisfaction index: 65.5	Training cou. duration > = 2 days: 4 Developer satisfaction index: 75.7
				Number of participants < 10: 3 Developer satisfaction index: 80.5	Number of participants >= 10: 5 Developer satisfaction index: 69.4

Figure 4-3 Values of the of the product development department and their effects on the developer satisfaction index (n = 10)

Effects of the characteristics of the projects

Figure 4-4 and figure 4-5 show that by means of variation in design parameters the degree of design goal achieving is partially substantially affected. This applies for example to project organization and project goals, in addition, to the application of the instrument as well.

Project-specific design parameters					
Group of characteristics			**Characte-ristic**	**Frequency of characteristic value and height developer satisfaction index**	
Characte-ristics of the projects (part 1)	Project organization	Organisational structure		Without structured project adjustment: 2 Developer satisfaction index: 50.1	With structured project adjustment: 12 Developer satisfaction index: 76.0
		Projects manager		From product development departm.: 10 Developer satisfaction index: 70.6	From other department: 6 Developer satisfaction index: 69.5
	Goals	Goal clarity		Not in writing fixes: 4 Developer satisfaction index: 58.2	In writing fixes: 12 Developer satisfaction index: 74.2
				Persons with goal knowledge < 100%: 7 Developer satisfaction index: 65.1	Pers. without goal knowledge = 100%: 9 Developer satisfaction index: 74.1
	Resources	Time for implementation of the project		Little time: 6 Developer satisfaction index: 68.8	Much time: 9 Developer satisfaction index: 74.3
		Exemption of the involved ones		Little exemption: 6 Developer satisfaction index: 67.8	Much exemption: 9 Developer satisfaction index: 75.0
		The premises		Few premises: 12 Developer satisfaction index: 74.2	Much the premises: 3 Developer satisfaction index: 62.8
		Material		Little material: 12 Developer satisfaction index: 74.2	Much material: 3 Developer satisfaction index: 62.8
		Aid of computers		Little aid of computers: 14 Developer satisfaction index: 71.7	Much aid of computers: 1 Developer satisfaction index: 77.2
	Team	Quantita-tive compo-sition	Number of members	Team < 10 persons: 6 Developer satisfaction index: 66.8	Team > = 10 persons: 5 Developer satisfaction index: 73.9
			Distribution of members	Customer only in one phase: 5 Developer satisfaction index: 63.7	Customer in more than one phase: 3 Developer satisfaction index: 77.7
			Stability team	Decrease < 5%: 10 Developer satisfaction index: 72.0	Decrease >= 5%: 5 Developer satisfaction index: 72.4
		Qualitita-tive compo-sition	Degree of cross-functionality	No cross-functionality: 4 Developer satisfaction index: 66.7	Cross-functionality: 12 Developer satisfaction index: 71.3
			Source of moderator	Internal moderator: 10 Developer satisfaction index: 77.3	External moderator: 6 Developer satisfaction index: 58.4
			Moderator powers	Moderator no project manager: 12 Developer satisfaction index: 72.3	Moderator project manager: 2 Developer satisfaction index: 55.7
	Time frame	Range of the preparation		No training before project: 4 Developer satisfaction index: 68.9	Training before project: 11 Developer satisfaction index: 73.3
		Interval between meetings		Interval < 7 days: 9 Developer satisfaction index: 73.7	Interval >= 7 days: 6 Developer satisfaction index: 69.7
		Duration of the meetings		Duration < 5 hours: 10 Developer satisfaction index: 73.1	Duration > = 5 hours: 6 Developer satisfaction index: 65.3
		Intensity of the meetings		Number of meetings < 10: 8 Developer satisfaction index: 67.9	Number of meetings > = 10: 5 Developer satisfaction index: 75.2
	Extent	Planning volumes	Customer requirements	No. of customer requirements < 20: 3 Developer satisfaction index: 50.9	No. of customer requirements >= 20: 13 Developer satisfaction index: 74.6
			Solution characte-ristics	No. of solution characteristics < 20: 4 Developer satisfaction index: 66.9	No. of solution characteristics >= 20: 11 Developer satisfaction index: 69.8
			Other cha-racteristics	More customer requirements: 7 Developer satisfaction index: 70.9	More solution characteristics: 7 Developer satisfaction index: 66.9
		Planning dimensions		Only product functions: 2 Developer satisfaction index: 67.8	Several dimensions: 11 Developer satisfaction index: 72.1
		Planning depth		One matrix: 9 Developer satisfaction index: 69.6	Several matrices: 6 Developer satisfaction index: 68.4
	Adjustment of the instrument	Extent of the project-specific variation		Project-independent proceeding: 6 Developer satisfaction index: 67.2	Project-specific proceeding: 8 Developer satisfaction index: 76.0
		Employment of supplementing methods		No supplementing methods: 9 Developer satisfaction index: 64.3	Supplementing methods: 7 Developer satisfaction index: 77.8

Figure 4-4 Values of the characteristics of the projects and their effects on the developer satisfaction index - part 1 (n = 16)

Project-specific design parameters					
Group of characteristics			**Characte-ristic**	**Frequency of characteristic value and height developer satisfaction index**	
Characte-ristics of the projects (part 2)	Application of the instrument	Separation customer requirements and solutions		Quantity as solution identified of the customer requirements < 10%: 3 Developer satisfaction index: 75.5	Quantity as solution identified of the customer requirements >= 10%: 9 Developer satisfaction index: 65.1
		Customer requirement analysis		No customers questioning: 7 Developer satisfaction index: 60.4	Customers questioning: 9 Developer satisfaction index: 77.8
				No questioning of other departments: 8 Developer satisfaction index: 62.6	Questioning of other departments: 8 Developer satisfaction index: 77.8
		Customer requirement weighting		Consent in group: 11 Developer satisfaction index: 73.6	Averaging: 5 Developer satisfaction index: 62.6
				Ranking on nominal scale: 2 Developer satisfaction index: 67.3	Determination of weights: 10 Developer satisfaction index: 70.4
		Customer group/market segments		No weighting customer groups: 4 Developer satisfaction index: 57.4	Weighting customer groups: 7 Developer satisfaction index: 74.9
		Competition benchmarking		No benchmarking: 4 Developer satisfaction index: 56.7	Benchmarking: 10 Developer satisfaction index: 74.0
		Correlation analysis		Number of gradations < 5: 11 Developer satisfaction index: 64.7	Number of gradations >= 5: 2 Developer satisfaction index: 83.9
		Interpretation of the results		Little number faith: 8 Developer satisfaction index: 73.0	High number faith: 6 Developer satisfaction index: 71.30
		Recording of the results		Pages documentation < 100: 12 Developer satisfaction index: 72.7	Pages documentation >= 100: 3 Developer satisfaction index: 57.7
		Preparation of the results	Diagrams	Number of diagrams < 10: 6 Developer satisfaction index: 72.6	Number of diagrams >= 10: 9 Developer satisfaction index: 67.8
			Information meetings	One information meeting: 7 Developer satisfaction index: 69.5	Several information meetings: 9 Developer satisfaction index: 70.7

Figure 4-5 Values of the characteristics of the projects and their effects on the developer satisfaction index - part 2 (n = 16)

In order to illustrate the development of the recommendations regarding the design of QFD projects presented in chapter 4.3, we describe exemplarily individual results in more detail below.

A written laying-down of the goals pursued within the product development project contributes to the efficiency of the QFD employment (see figure 4-6). If furthermore one succeeds to make all persons involved in the project familiar with these goals an increase of the efficiency can be expected as well.

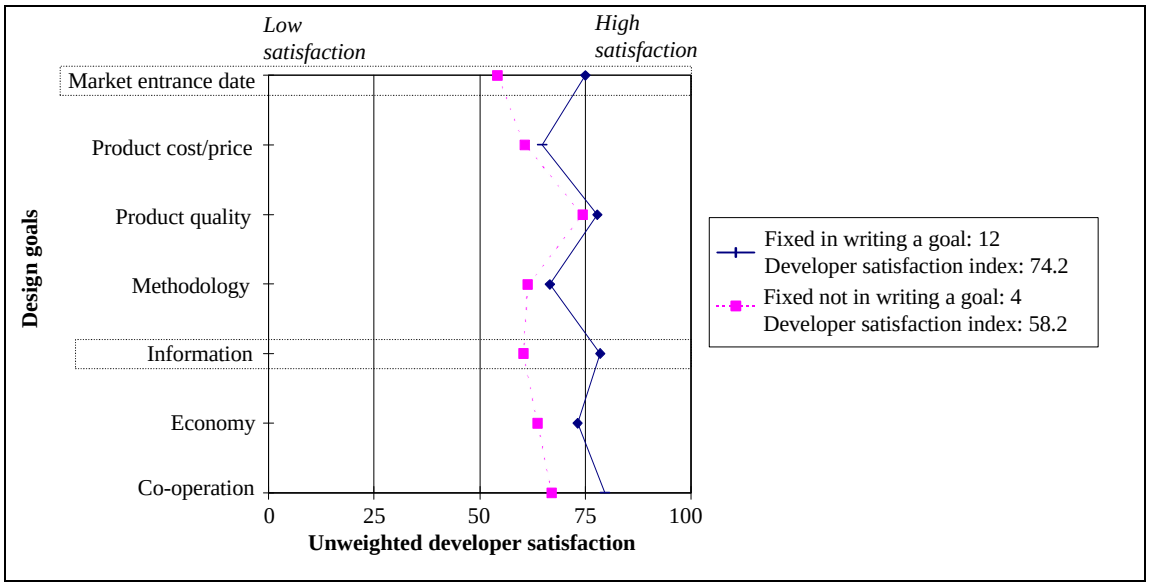

Figure 4-6 Values of the characteristics of the goal documentation and their effects on the developer satisfaction with the design goals (n = 16)

A project-specific proceeding leads to a higher developer satisfaction index than a badly adjusted standard procedure. The effort of employing supplementary methods according to demand corrects the information base for the product design and therefore allows a higher product quality (figure 4-7).

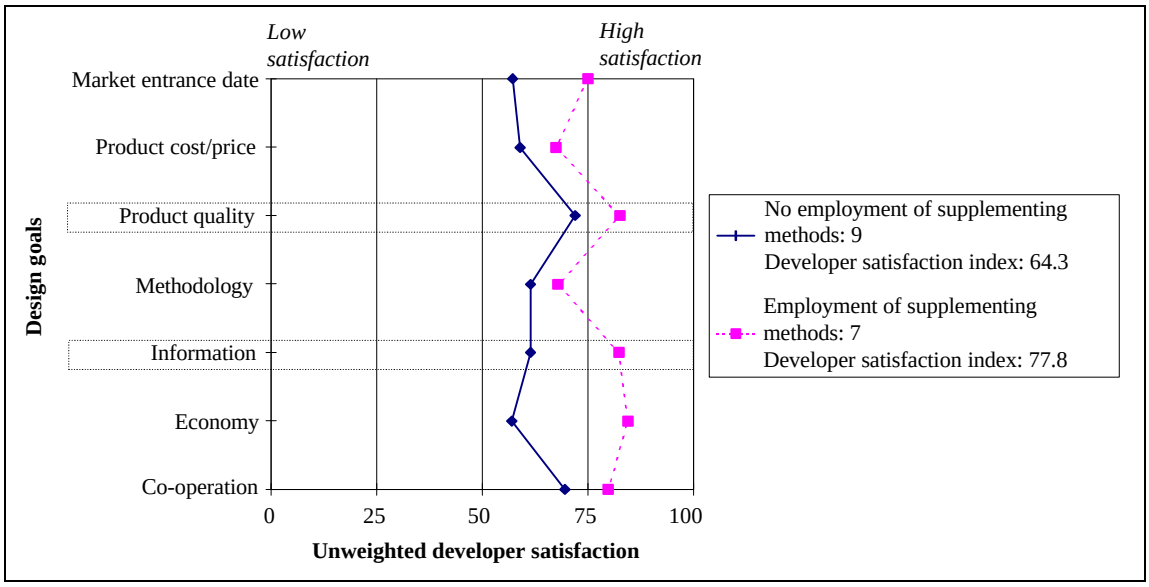

Figure 4-7 Values of the characteristics of the employment of supplementing methods and their effects on the developer satisfaction with the design goals (n =16)

Figure 4-8 clarifies the need for a customer questioning in particular regarding the project-related goals.

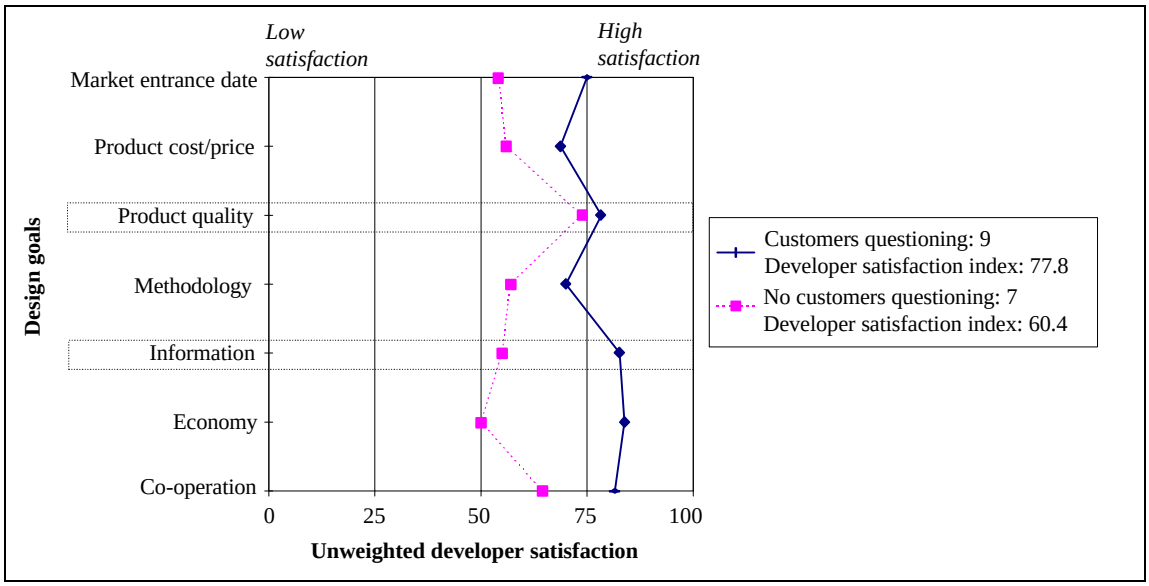

Figure 4-8 Values of the characteristics of customer requirement analyses by customer questioning and their effects on the developer satisfaction with the design goals (n = 16)

Customer questioning leads to a higher relative quality. The largest positive effect, however, is to be observed regarding financial aspects. With the help of the information determined during the direct customer questioning the development of redundant product characteristics can be probably avoided. Apart from a high acceptance of the price on sides of the customer and low product costs this leads additionally to a shortened development time. From figure 4-9 it becomes evident that a sufficiently large accuracy with the customer requirement analysis causes a high developer satisfaction index as well as a large efficiency concerning the design goal information. Furthermore, with a higher number of customer requirements the product quality is improved a little.

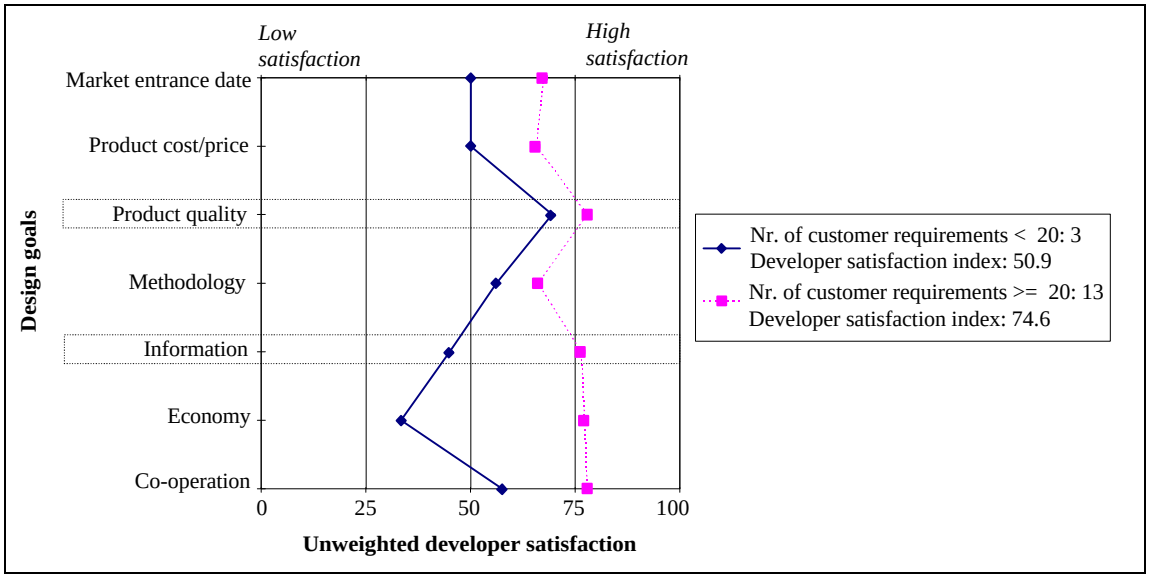

Figure 4-9 Values of the characteristics of the planning volume and their effects on the developer satisfaction with the design goals (n = 16)

The high developer satisfaction verifies the need for a differentiated view and weighting of different customer groups and/or market segments. By this - as figure 4-10 shows - an increase in efficiency concerning all design goals is achieved.

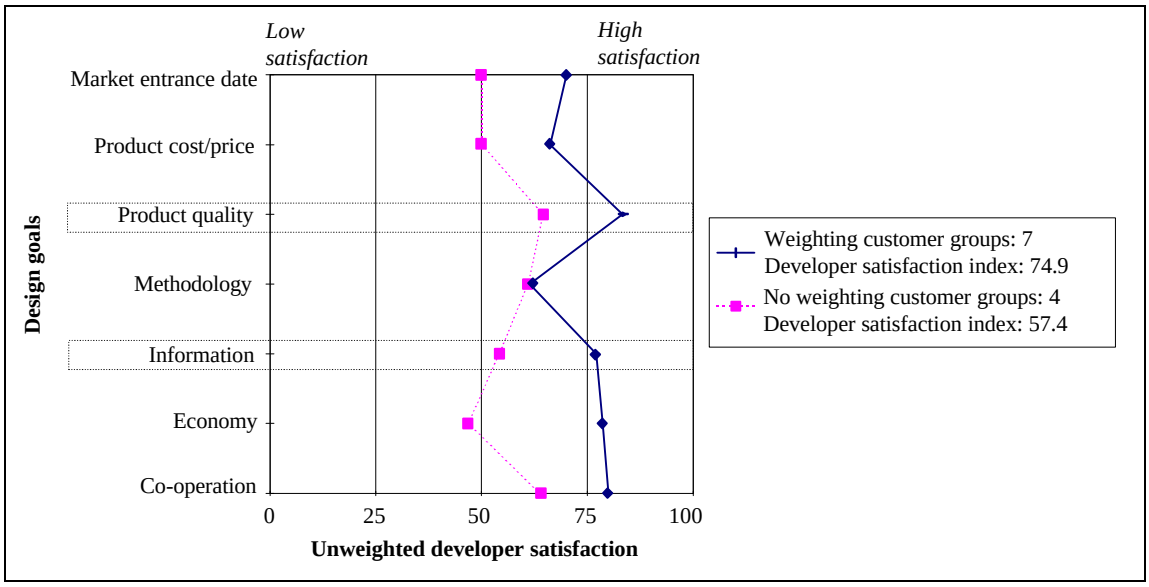

Figure 4-10 Values of the characteristics of the weighting of customer groups and their effects on the developer satisfaction with the design goals (n = 11)

4.3 Recommendations regarding the design of QFD projects

The existing data shows that a QFD project arranged in accordance with the theses leads to positive effects on the reaching of the design goals. The design recommendations formulated in the 15 theses are confirmed to a large extent both regarding the developer satisfaction and the comparison of characteristic values of the best and the worst QFD project. Only the importance of the design parameters in the theses P2 (support of the instrument employment) and P5 (project resources) in the sample is smaller than expected. All in all the formulated design recommendations regarding the customer-oriented product development can be confirmed with the help of the existing data. Therefore the following fundamental recommendations regarding the design parameters with positive effect on the realization of customer-oriented design objectives are to be emphasized:

- An innovative product development strategy which commits all employees to quality responsibility;
- a bottom up introduction strategy by pilot projects and an at least two-day training with a number of participants of less than ten persons;
- a structured project organization;
- the written laying-down of the project goals and their passing on to all employees of the project;
- a department-spreading interdisciplinary, more than ten persons containing project team - also including customer representatives -, led by a project manager who doesn't act at the same time as moderator of group meetings;
- a project-specific adjustment of QFD using supplementing methods (for example from the marketing

department);

- a comprehensive survey of the customer requirements and determination of solutions which contain both functional and non-functional characteristics;
- an intensive, direct and indirect customer questioning concerning customer requirements and customer satisfaction (absolute and in the comparison to the competition);
- a stringent separation between customer requirements and (technical) solutions as well as
- a detailed correlation analysis of the connection between customer requirements and (technical) solutions.

5 Critical reflections on the results

This work´s intention was to provide a concept for the success factor analysis of QFD projects to test it in an empirical investigation and to identify success-promoting factors. Due to the small number of enterprises which can refer to practical experiences with QFD in no phase of the work a general validity of the test results was raised. In the literature the disregarding of relevant variables and a missing scientific foundation of existing success factor analysis concepts are marked critically (Lehner, F., 1995 and Preiß, F. J., 1991). This criticism can be rejected for the present concept due to the comprehensive collection of project success affecting determinants and objectives and the selected decision-theoretical approach. On the other hand, one cannot reject the frequently stated criticism of the missing weighting of the success factors. However, this is caused not by deficiencies of the concept but the narrow empirical basis of the study. With a more strongly quantitatively aligned investigation it could be possible to draw conclusions from the developer satisfaction indices on the importance of the individual characteristics responsible for the increase of project success.

References

Ahlemeier, G. and Herzwurm, G. (1998): Erfolgsfaktoren von QFD-Projekten. Ergebnisse einer empirischen Untersuchung. Studien zur Systementwicklung des Lehrstuhls für Wirtschaftsinformatik der Universität zu Köln. Vol. 14. Köln

Bortz, J. (1984): Lehrbuch der empirischen Forschung. Berlin et. al.

Curtius, B. (1995): Quality Function Deployment in der westdeutschen Automobilindustrie. Versuch einer Darstellung hemmender und fördernder Faktoren. Aachen

Ehrlenspiel, K. (1995): Integrierte Produktentwicklung. Methoden für Prozeßorganisation, Produkterstellung und Konstruktion. München et. al.

Griffin, A. (1992): Evaluating QFD´s Use in US Firms as a Process for Developing Products. In: *Journal of Product Innovation Management*, pp. 171-187

Eisenführ, F. and Weber, M. (1994): Rationales Entscheiden. 2nd Edition, Berlin et. al.

Frese, E. (1995): Grundlagen der Organisation. Konzept - Prinzipien - Strukturen. 6th Edition, Wiesbaden

Hayes, B. E. (1992): Measuring Customer Satisfaction - Development and Use of Questionnaires. Milwaukee

Herzwurm, G. (1998): Systematische Herleitung eines Instrumentariums zur kundenorientierten Softwareproduktentwicklung. Habilitation paper, Wirtschafts- und Sozialwissenschaftlichen Fakultät der Universität zu Köln. Köln

Herzwurm, G., Schockert, S. and Mellis, W. (1997): Qualitätssoftware durch Kundenorientierung. Die Methode Quality Function Deplyoment (QFD). Grundlagen, Praxisleitfaden, SAP R/3 Fallbeispiel. Braunschweig - Wiesbaden

Hunt, R. B. (1997): Applying QFD principles to strategic transformation. In: *Transactions from the Ninth Symposium on Quality Function Deployment*. Novi, Michigan, pp. 235-263

Kubicek, H. (1975): Empirische Organisationsforschung. Konzeption und Methodik. Stuttgart

Lehner, F. (1995): Die Erfolgsfaktoren-Analyse in der betrieblichen Informationsverarbeitung. In: *ZfB - Zeitschrift für Betriebswirtschaft*, No. 4, 1995, pp. 385-409

Omagbemi, R. (1994): Die Messung und Beurteilung der Effizienz von Projekten der angewandten Forschung und Entwicklung. Berlin

Preiß, F. J. (1991): Strategische Erfolgsfaktoren im Software-Marketing. Frankfurt et. al.

Schmelzer, H. J. (1992): Organisation und Kontrolle von Produktentwicklungen. Stuttgart

Specht, G. and Schmelzer, H. J. (1991): Qualitätsmanagement in der Produktentwicklung. Stuttgart