1.1 CASE C - Market success with systematic product planning

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1.1.1 Introduction

Different stakeholders often perceive complex problems differently. This case study shows how important it is to analyse and structure the problem systematically. This can be costly and requires a systematic procedure.

The case describes how a group of product of a medium sized company with about 100 employees that had not enough success in the market could be improved considerably and permanently.

In particular methodological aspects in regard to the complexity of the task are emphasized. A special characteristic of this case is the combined application of SE concepts and portfolio and value analysis.

Why this Project?

Filtronix AG has been manufacturing clean room equipment for 40 years. The company was founded by Viktor Jausslin who brought the idea from the USA where he stayed with his uncle Albert after his studies. Uncle Albert was employed in a management position at the R&D laboratory of Micropollution and called his nephew's attention to a development that was quite advanced in the USA at that time: The market for clean room and laboratory equipment had grown remarkably, driven by the fast growing biotechnology and micro-biology industry. Micropollution – one of the biggest American producers of this kind of equipment – could increase its turnover by more than 15% annually. With the support of his uncle Viktor Jausslin company Filtronix became the general importer for Micropollution's products in Switzerland. Jausslin turned out to be an excellent salesman and an innovative spirit. At the beginning of the 80s, Filtronix was a prospering wholesale company, selling, servicing and maintaining clean room equipment in Switzerland.

This intensive growth wore on Jausslin's strengths. Because of resulting health problems, his doctor recommended to cut down activities. With a heavy heart, he decided to sell his company. The new owners, an international holding active in different businesses, had to promise to keep the 30 employees of Filtronix which they did. The alliance of Filtronix with the new owners, however, only lasted three years. In the course of a strategic reorientation the business area clean room technology was abandoned. Filtronix was to be sold again. With the financial support of Jausslin who never lost contact with his former managers, the three-man management team accomplished a management buyout. Jausslin became chairman of the board and left the executive management to the three partners.

In the following years, Filtronix had increasing problems with procurement. Continuously rising wholesale prices of their American suppliers and unfavourable exchange rates influenced the profit situation negatively. On the 1st of April of 1988, Jausslin called a meeting with the general management to discuss the situation. He proposed to start the development of their own products to reduce the dependency from the American procurement market. There was a tempered discussion about this new strategy. Finally, Jausslin prevailed late in the evening. It was decided to establish a design department to develop equipment for clean rooms. The strategy was to have all equipment manufactured by third parties. Slowly, Filtronix developed equipment, most of it customised products that were sold very successfully. In four years the turnover doubled. Filtronix had changed from a national wholesale company to an internationally active company that had about 70 % of its products manufactured by third parties. The workforce increased to 70 people over this period. When a trend to a more flexible use of laboratories and laboratory equipment emerged in 1992, Filtronix took the chance to start a new product group. User requirements changed more quickly, so equipment had to be able to be rearranged in the laboratory more flexibly to enable optimal work processes. . Yet, traditional laboratory equipment used to be firmly attached to the buildings and furnished with fixed supply systems (power, water, gas, air-conditioning etc.). If one was to change the use of a piece of equipment, time and cost intensive modifications to the building's infrastructure were necessary. In this situation a large Swiss chemical company in Basel established an interdisciplinary team to should investigate the flexible use of laboratories and the lab technology its environmental impact. The main problem was the extractor hoods used in laboratories at that time. Isolated work places prevented the spread of polluting gases into the surrounding laboratory space. This required large air channels that limited the flexible use of a building considerably. The laboratory technology design office of that chemical company developed a system specification for a new product generation that would solve every weakness they spotted. They also built a prototype themselves, however it did not meet their expectations. The attempt to find a European producer for extractor hoods for the project failed, because production costs would have been too high, and development time too long. Dr. Marc Lachapelle, chemist and head of R&D at Filtronix, learned about the project by chance from a friend who he had known during his time working at that chemical company. Filtronix was producing conventional extractor hoods, and became interested in the project. With the active support of Jausslin, Filtronix built a functional prototype, four laboratory devices for the chemical company and one device for security tests within only six months. Quickly the German Institute for Standardisation approved the conformity of the device with the relevant DIN standards. The chemical company awarded Filtronix the worldwide license to market this product idea.

Until today Filtronix has produced, installed and successfully sold a remarkable quantity of these devices. Although the devices had considerable advantages in terms of quality compared with their main competitors, the economic success did not develop as planned. At a management meeting, called for the analysis of the unpleasant situation, Dr. Lachapelle and Martin Bodmer, head of sales, got into a row.. Bodmer blamed Dr. Lachapelle for including the new product into the product range without a systematic market analysis. Dr. Lachapelle defended his product with the argument that no other competitive product had comparable performance features. All the users in the laboratories only gave good feedback on the product. The problem would be in the sales process itself. Sales responded to price discussion with luscious discounts instead of emphasizing the high performance and the quality of the product.

> Note: When reviewing why the project was started, the first hints about the differing views of the problem the various partners held and about possible objects of investigation emerge. Positioning the product in the marketplace seems to be one of the main issues in the case of Filtronix.

Jausslin had to use all his influence to calm down the disputing partners. He was convinced that the high production costs and therefore the high sales price were the cause for the dissatisfactory revenue situation of the new device. Therefore he advises his partners to engage a consultant who should propose recommendations for how to half the production costs. Jausslin was surprised when his proposal found general acceptance. He contacted me the next day. I accepted the mandate, well knowing that it was a complex, interdisciplinary problem.

How Did We Approach the Task?

Because of the lack of secured facts, we agreed to carry out a situation analysis in the form of a preliminary study.

> Note: The real problem was not known at that time. Information about possibly successful directions was missing, i.e. it was still open where to look for solutions. In this situation it makes sense to carry out a preliminary study to get some clarification.

First I started to analyse the task at hand. This meant:

- identify problem areas
- define project objectives and general framework
- outline the boundaries of the study
- define the process organisation of the project
- structure the project in functional phases

The five steps are described in detail below:

With the support of Jausslin I organised different interviews with members of the management and selected employees. As expected, the identification of problem areas was very difficult because of different point of views. The question ‘what the product should deliver’ was not answered unanimously. I remembered a conversation with Jausslin, on the occasion of the acceptance of the mandate, when he mentioned that he would not accept to reduce the functionality of the product as a solution. An almost unsolvable problem if the production costs should be cut in half! The technicians found it impossible; sales found it not enough. On the other hand, for me it was clear that the potential for cutting down the production costs was highly dependent on the product's performance characteristics. The question had to be clarified which characteristics of the product were necessary. I started to make a draft (fig. 9.14) that outlined the determinants of the product's success and their interconnections in a visual form as a basis for discussion.

> Note: Shared models, even in the form of hand drawings, are important elements of problem solving in teams.. The objective of the model creation is to structure the situation and to create shared understanding and shared expectations of all participants.

I took the drawing to our next meeting where I propose the new definition of the problem and a new project objective to Jausslin. The basic problem we would address would be the lack of competitive advantage rather than the high production costs. Product characteristics that did not meet a market requirement could also be part of the problem. The characteristics of the product had initially been determined according to the requirements of the licensor, yet they had never been reviewed since the development of the device eight years ago. How the market and the customer requirements had developed would have to be taken into account. As the new objective of the project, I proposed to improve the competitive advantage of the device. Jausslin followed my presentation attentively and agreed with my understanding of the problem. However, he feared that a time consuming analysis would compromise our time schedule.

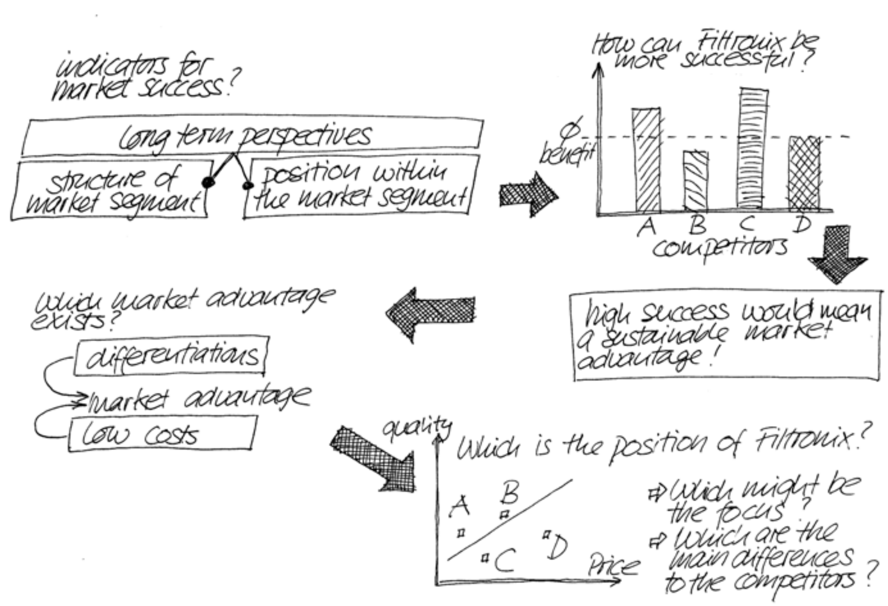

Fig. 9.14: Draft of the determinants of the product's success and their interconnections

Note: The original objective to 'cut production costs in half' was not was not solution neutral for the actual problem of a insufficient market success. This illustrates that it is sensible to do a task analysis at the beginning of a project.

Apparently I was able to dispel the fears of Jausslin. Shortly after our meeting I received a note from him stating that the project should be started with the changed project objective and respecting these conditions or degrees of freedom:

- design and material changes were allowed. The outer dimensions of the device, however, could not be changed.
- according to the manufacturing strategy, all sub-assemblies and components would have to be sourced from third parties. The final assembly would still be done in-house.
- the predetermined project deadlines had to be met.
- the day-to-day business must not be affected by the project.

Based on the changed project objective, it became clear that the customer requirements and the main competitors had to be examined in the project (fig. 9.15).

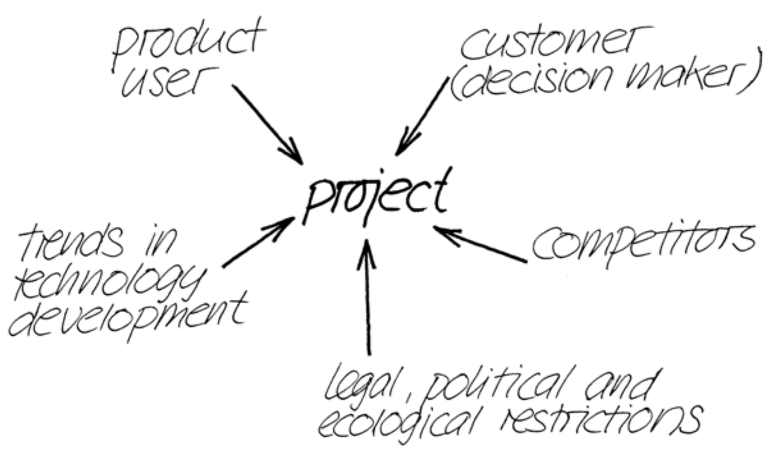

Figure 9.15: The most important parameters of the project

Furthermore, it was recognized that in many cases the actual users of the product were not identical with the persons deciding about the purchase of the product.

The management structure for the project was derived from the project tasks. I took over the role of the project manager and coordinator. In this role I was responsible for the methods used and the progress of the project in terms of results, deadlines and costs. Furthermore, I would allocate my time and know how to develop solutions for partial problems. The steering committee of the project, consisting of Jausslin (president of board), Bodmer (head of sales) and myself, would decide on strategic questions. of each of

According to the task, R&D, sales, procurement and manufacturing sent one representative to form the project team.

To account for the complexity of the problem and based on the experience I had from similar projects it was agreed to structure the project steps according to the proven phases of SE, however in a slightly adapted form (fig. 9.16).

Level	***Key questions***
Strategic level	How should the product perform? How much is the customer willing to pay for it? What are the target production costs and the target costs per function?
Product design	Which technologies allow to realises the required functions with the least costs?

Figure 9.16: Phases of the project indicating relevant problem areas

It was decided to carry out a preliminary study with a comprehensive situation analysis (fig. 9.17).

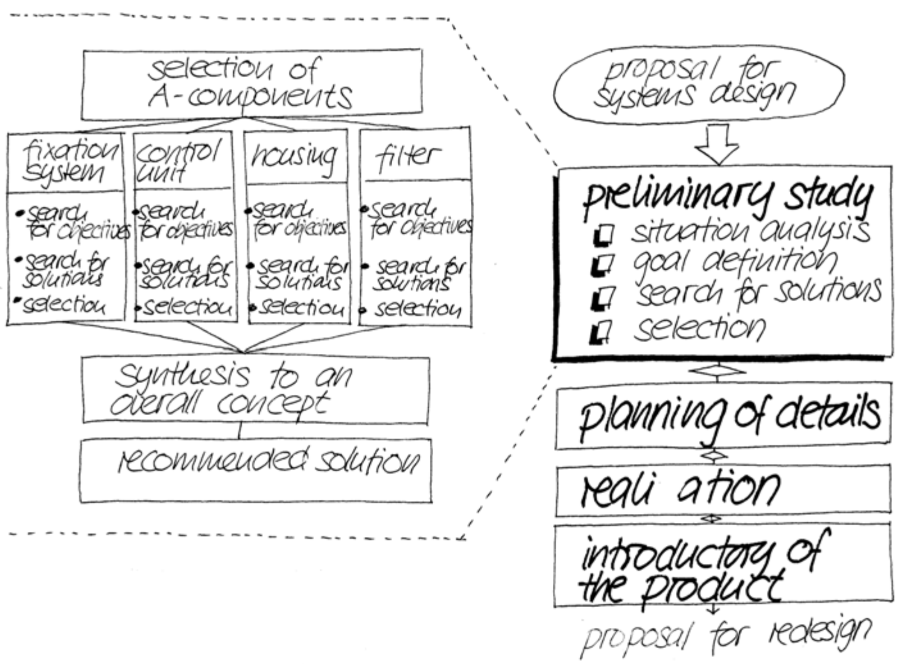

Figure 9.17: From general to detail: different levels of analysis and key questions

Note: In contrast to the classical life cycle model of systems engineering, there was no main study in this project that would end with a decision about the overall concept to be. To completely redevelop the product was out of question. Additionally, the preliminary study was expected to include a comprehensive situation analysis that would deliver the necessary information to develop a solution for the problem, to assess its consequences and to identify any prerequisites to implement it. Four critical problem areas had already been identified in the project proposal. They each would be investigated separately. The separate solutions would then be consolidated into an overall solution.

It was agreed to review the strategic positioning of product as a general, high-level analysis. The aim of this analysis was to give direction to the search for solutions for the product design on a secondary level of analysis. Additionally, value analysis would support the customer oriented optimisation of the product. To reduce the complexity of the problem it was agreed to closely examine, on a strategic level, the customer benefits, the competitive advantages and disadvantages and the position of the product in the marketplace. This would result in a strategic decision about the desired position of the product (fig. 9.17).

1.1.2 Preliminary Study

The preliminary study would be carried out according to an agreed project plan (fig. 9.18).

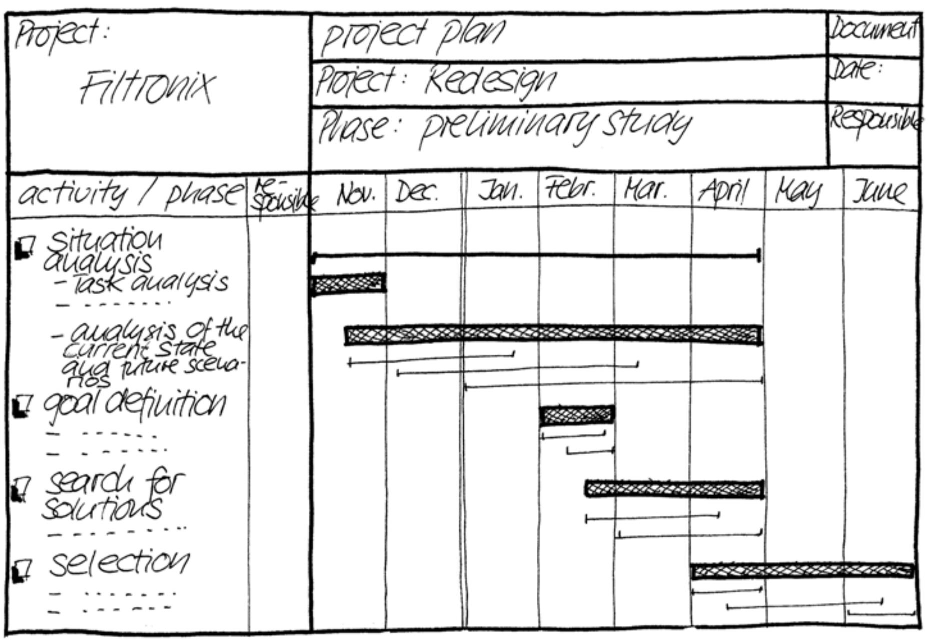

Figure 9.18: Project plan

The action plan in figure 9.18 reflects a cyclical procedure. Parts of the problem solving cycle are run in parallel. Additionally the action plan shows that the focus of the work is on the situation analysis and the goal definition. This relative importance of the activities is typical for a preliminary study.

Below, we describe four parts of the analysis of the current state in more detail:

- customer benefits and strategic position of the product
- overall cost analysis
- identify the functions for the value analysis and
- determine the cost contribution for each function.

Customer benefit and strategic position of the product

Based on Filtronix own assessment and on the opinions of selected customers the reasons to buy a product and their importance in the customers' views were identified. Subsequently the product of Filtronix and the products of its main competitors were rated on how they would meet these criteria.

As I had presumed and expected, the process of defining the customer benefit was accompanied by discussions about the present and future needs in the marketplace. In retrospective, this intensive examination of the customer benefits was very fruitful. The analysis of the customer benefits (fig. 9.19) showed that in all important to very important criteria for the purchase decision (value higher than 8) the product of Filtronix had higher competitive advantages, with exception of the criteria of conformity with standards (fig. 9.20).

customers benefits / reasons to buy the product								
business unit:	product				year of investigation:			
market segment:	new design				date of investigation:			
Source: own evaluation and evaluation by decision maker								
user criteria (not price related)		**importance for the customer in %**	**customer related evaluation** (0 = very bad; 10 = excellent)					
			own product	**product of competitor**				
				A	**B**	**C**	**D**	
product related criteria								
compliance with standards		9	6	9	10	8	8	
operation costs		12	7	6	7	6	7	
additional infrastructure needed		18	9	6	6	5	6	
flexibility in the use of the product		15	9	6	6	5	6	
risk of damaging people's health		10	8	6	7	6	7	
risk of fire		12	9	4	4	5	4	
environmentally friendly		7	8	5	5	5	5	
design / attractivity of the product		4	7	5	6	5	4	
ergonomic design		5	7	7	7	6	7	
service related criteria								
service and maintenance		8	6	7	6	6	8	
overall benefit		100						
price [index]			100	33	30 - 50	30 - 50	30 - 50	
market share [%]	(Switzerland / Germany)		3 / 0	50 / 0	20 / 30	5 / 15	20 / 0	
customer's decision	*relevance of benefit*	35						
to buy the product	*relevance of price*	65						
		100						

competitor
A:
B:
C:
D:

Figure 9.19: Customer benefits for the market segment 'new development'

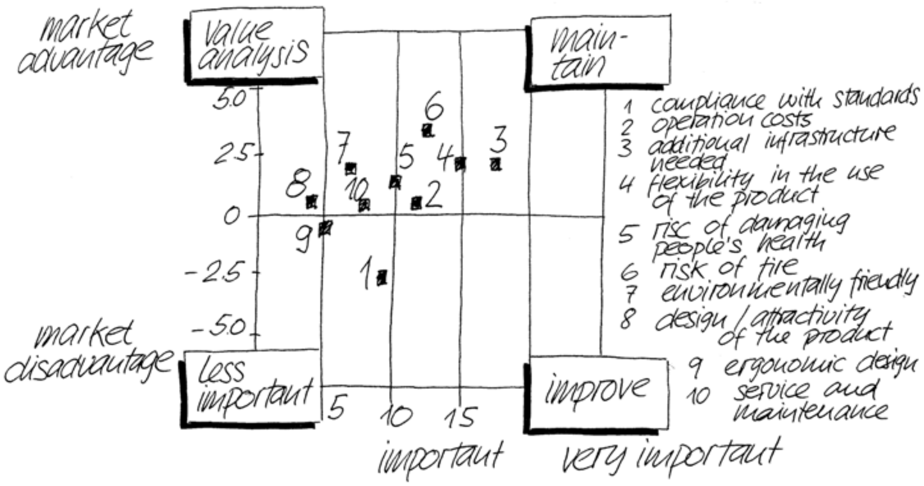

Figure 9.20: Relative importance and competitive advantage per criterion in a purchase decision

For the less important criteria (value less than 8), the analysis showed that there are advantages in regard to design and environmental impact of the product and disadvantages in regard to ergonomics.

To analyse the problem on a higher strategic level served two aims. On one hand it had to be confirmed whether the problem was tackled from the right point respectively whether all aspects of the problem were addressed. On the other hand, we wanted to gain an almost complete overview of the possible basic solutions. This even led to additional solutions such as reducing competitive advantage for criteria that are seen as less important. This particular solution was further developed using value analysis.

The competitive analysis was concluded by determining the current strategic market position of the product (fig. 9.21). The straight line in figure 9.21 represents the expected, ideal price-quality-ratio (in the view of the customers) is represented by the. A position to the left of the line means that, from a customers point of view, the product is too expensive; to the right of the straight line it is too cheap. Figure 9.21 confirmed what Jausslin had suspected, that the product was too expensive. On the other hand it became obvious that all competitors had chosen similar market positions, i.e. with relatively low prices and relatively low quality. Although the market was price sensitive and 65% of the purchase decision of the customer was determined by the price and only 35% by the quality (fig. 9.19), Filtronix was following a quality strategy with its product.

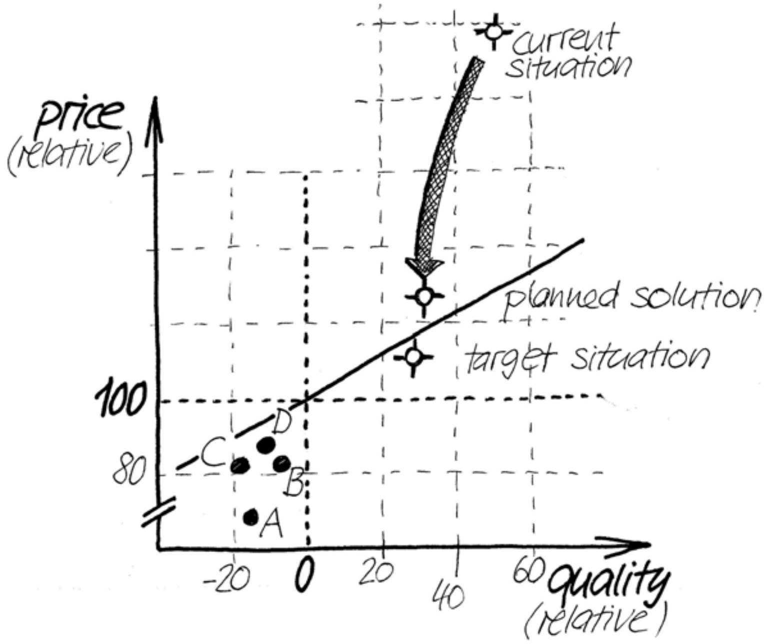

Figure 9.21: Strategic positioning

Note: This functional differentiation of the problem area in the situation analysis, especially taking into account the market and customer needs and the position of the main competitors, helped to identify a weakness of Filtronix' own position.

With its distinct quality strategy Filtronix did not reach the main market only a niche market with a low sale potential.

The discussion on the strategic level lead to two further interesting candidate solutions:

- covering different market requirements with one or more products.
- combination of two existing product lines into a modular product allowing for multiple use of parts and components and opening up additional retrofitting options for each market segment.

All the candidate solutions then were further detailed and elaborated until they could be compared. Filtronix decided to keep the product lines separate. This required a reposition the product (fig. 9.21).

Total Cost Analysis

Based on the cost analysis, four fifths of the production costs were material costs. The majority of the material was semi-finished products. The laboratory device consisted of more than 100 individual parts and subsystems. The analysis of all components would have taken us beyond the scope of the project and would have lead to disproportional expenses. An ABC analysis showed four components that were responsible for half of the production costs (see fig. 9.22). Because of the relatively low added value by Filtronix itself, the suppliers had a high importance regarding the cost reduction potential.

components	*Production costs / component*	*Production costs/component in % of the total production costs*
Housing	1'223.00	17.6
Filter	1'057.00	15.2
Control unit	541.00	7.8
Fixation system	425.00	6.2
Total	***CHF 3'246.00***	***46.8%***

Figure 9.22: Production costs of the four most important components.

Identify functions for the value analysis

The functions of the product were identified in order to help structuring its characteristics and to find new solutions that would go beyond the existing ideas and their current cost implications. (fig. 9.23).

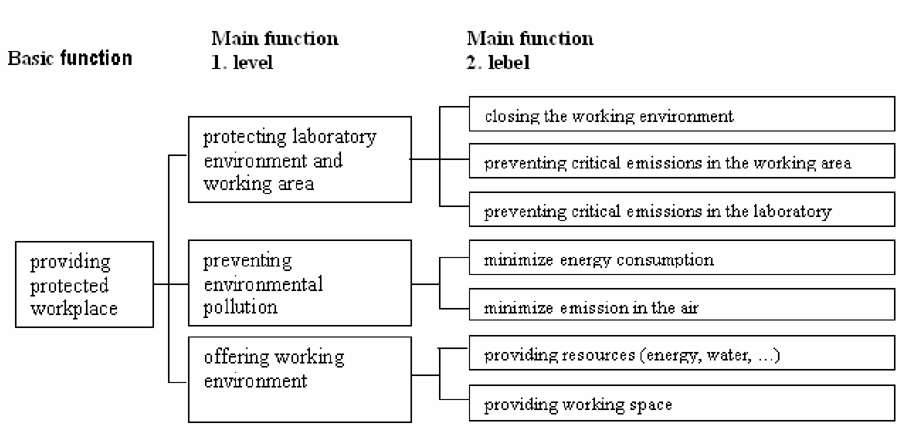

Figure 9.23: Actual functional structure of the laboratory device

Note: The functions and properties of the laboratory device have been defined as abstract functions to be uses in the value analysis. These functions are independent from their technical implementation (i.e. they are solution neutral), so an unbiased search for new solutions is now possible.

‘Thinking in functions’ is an approach that focuses on the benefit of a function. There are always many solutions that could implement one function of a product, for example the joining of parts can be done by screwing, gluing, soldering, pinning; the different solutions differ in costs, technology and compliance with the requirements. The functions as used for value analysis are constant parameters; therefore competing products will have the same functions, if these are mandatory functions the product has to provide (main functions). Competing product may be using a simpler or less costly solution for the same function.

Determine the Cost Contribution for each Function

When all functions had been identified, their cost contributions were determined by assigning all costs of components used to provide the corresponding function (fig. 9.24).

		protecting laboratory and working environment			offering working environment		preventing environmental pollution		
side functions 2nd level / function related part	*cost and material in % of the whole product*	*preventing critical emissions in the laboratory*	*preventing critical emissions in the working area*	*closing the working environment*	*providing working space*	*providing resources (energy, water, ...)*	*minimize emission in the air*	*minimize energy consumption*	*Total production costs*
part A	%	70		10		10	5	5	**328**
	CHF	230	-	33	-	33	16	16	
part B	%		33				33	33	**312**
	CHF	-	104	-	-	-	104	104	
part F	%		33				33	33	**204**
	CHF	-	68	-	-	-	68	68	
function related costs		**1526**	**1595**	**486**	**624**	**971**	**694**	**1040**	**6936**
		3607			**1595**		**1734**		

Figure 9.24: Cost contributions of the different functions of the laboratory device (part of the complete list)

Then, the contribution of the A-components (see fig. 9.22) was then evaluated. It became obvious that an effective reduction of functional costs could be achieved by focusing on the A components.

> Note: As part of the preliminary study, extensive and detailed clarifications were conducted to identify the actual problems and their causes. Based on the results it is now possible to define meaningful requirements and objectives for the future solution.

Definition of objectives

Filtronix had decided to omit the function ‘reduce exhaust air’ (fig. 9.23), based on the situation analysis. This opened up a potential to reduce costs by 10%. The functional objective ‘keep energy consumption small’ was to be kept. Furthermore the high costs of the function ‘media supply’ (power, water, gas, climate and more) were recognized now. It was decided that this should be an optional feature in the future, and that a basic model should be defined. Thus it became possible to reduce production costs by an additional 14%.

> The market and customer related optimisation of product performance characteristics already showed a potential reduction of production cost by 24%. In the situation analysis this conclusion is only possible if the problem boundary is defined properly and if the analysis goes into sufficient details.

It was decided not to define cost objectives for each single function because an analysis of functional cost contributions of the main competing products was not possible due to a lack of time. Instead, more cost effective ways to produce or source the A-components should be found – while maintaining the functions.

So the desired position was reached, as presented in figure 9.21, which was substantially closer to the expected ideal price-quality relation. The product, however, should still be of better quality than the products of the competitors, which I do not consider to be the optimal strategy. Filtronix based this decision on the belief that the customers would be prepared to pay a 25% premium for the higher quality of the product.

Search for solution and selection

The general requirements for the A components were defined in a functional specification document. This was sent to suppliers requesting their offers. This resulted in a further reduction of production costs by 22%. Together with the market- and customer-specific optimisation of product performance characteristics this resulted in an identified total cost reduction of almost 50%. So it was possible to implement new solutions quickly and efficiently.

> Note: In contrast to the standard SE procedure, this project had no main study with a decision for a general solution at its end. The preliminary study aimed to identify the objectives and the strategic direction of any measures to improve competitiveness. Because of the lack of secure facts, it was agreed to carry out a comprehensive situation analysis as part of the preliminary study. In the detailed planning phase that followed the preliminary study immediately, the individual partial solutions were refined so they could be implemented and introduced directly.

1.1.3 What are the Conclusions from this Case?

- Complex problems are perceived differently by different participants and stakeholders. A successful problem solution requires the creation of a shared understanding of the problem. This process can be elaborate and requires a systematic approach in the diagnostic phase.
- Setting meaningful boundaries, structuring of the problem area and taking into account competitors and the needs of customers helped to understand the complex circumstances and opened perspectives for new solutions. However not all participants did understand right from the start why the problem scope had to be extended.

- It is especially difficult for a designer who was involved from the beginning of the initial product to question existing solutions. Working on the problem as an interdisciplinary team, in other words involving all persons affected and including project sponsors from top management, supports the acceptance of the solution.
- Introducing the problem on a higher, strategic level, narrowing the perspective step-by-step on product design and developing options on both levels corresponds to the approach ‘from general to detail’. Thus all important problem aspects can be collected and an almost complete overview of all solutions that are possible in principle can be developed.
- As project structure, as division into preliminary study, detailed planning, realisation and product introduction was selected. Clearly structuring the phases and explicit decision making with auditable decision processes helped to secure the acceptance for radical measures.
- The problem solving cycle was applied several times for different problem areas and in combination with value analysis approaches. Explicitly taking into account customer and market needs and – as a result – defining desired functions are a concrete example for a goal hierarchy which secured the development of a market driven product.
- The basis to find innovative, technical solutions was to present the functions of the product as abstract concepts and to determine their cost contribution. It became obvious, that it was not always easy to clearly separate the solution neutral function (part of the goal definition) and their technological realisation (part of the concept synthesis)

The potential to reduce production costs was estimated in the preliminary study to be almost 50%, almost 40% cost reduction could be realised later. About half of it was due to market and customer specific optimisation of product performance characteristics and the critical examination and optimisation of how functions were realised, respectively.