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STRATEGIC DIVERSIFICATION BY NETWORK PORTFOLIO ANALYSIS

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1. Introduction

Today enterprises continuously have to come out with new products to retain competitiveness and to ensure sustainable growth. The competitive environment is characterised by global competition, increasing innovation dynamic, and shortened product life time. Many companies try to respond to these requirements by improving products, cutting costs, and process reengineering. Another, more strategic way to realise sustainable competitive advantage is to develop completely new products or to enter new markets [Kreikebaum 1997]. Possible strategic opportunities are illustrated in figure 1. Here, diversification is suggested as a growth strategy where new products are developed for new markets. The strategy of diversification is considered to be most risky, because the business is moving into products and markets in which it has little or no experience. Hence, a clear idea about what is expected to gain from the strategy and an honest assessment of risk is seen as indispensable. As well, synergetic diversification, that means the utilization of existing product and market know how, is seen as an appropriate measure to reduce risk.

	Existing markets	New markets
Existing products	Market penetration • Product improvement • Product variants	Market development • New market segments • New customers • Internationalisation
New products	Product development	Diversification • Horizontal • Vertical • Lateral

Figure 1. Strategic opportunities according to Ansoff [Kreikebaum 1997]

Unfortunately, in practice companies often do not know, which new product areas they should focus on. Major enterprises have sufficient organisational capabilities to conduct extensive basic research and to watch market and technology development intensely. However, small and medium-sized enterprises (SME) have not. Here, strategic management often is not that systematic and well structured. Rather it happens on the basis of personal notions and spontaneous feelings. Prevalently, new product ideas are emerging from sales requirements. Often they are not evaluated concerning

their strategic fit or possible synergies. Consequently, some enterprises offer a very broad product range. As well the business of small and medium-sized enterprises is often predominated by day-to-day activities, which keep the staff from developing new product ideas or elaborating strategic opportunities in-depth. Then again small and medium-sized enterprises cannot afford to develop products, which later fail on the market, because resources are strongly limited. Hence, there is a strong need for strategic management in SMEs as a prerequisite for a successful product development. Yet, methods of strategic product development must not be too sophisticated [Gausemeier et al. 2004].

In the contribution at hand a method shall be presented, which was developed to help SMEs finding new product ideas in a systematic but still comparatively short way.

By the method of network portfolio analysis a strategy of synergetic diversification shall be supported. New business opportunities shall be identified by analysing existing, successfully established product portfolios of competing companies. As well, companies are supported in getting an in-depth inside of their competitive environment. In the following section the methodological approach will be presented in detail. Afterwards the application of this method will be demonstrated in a case study. Finally conclusions on the method and its application will be presented.

2. Methodological approach of network portfolio analysis

The presented method is based upon the idea of benchmarking, where best practices shall be identified through comparison with other companies. The basic methodological approach of network portfolio analysis is the comparison of product portfolios of various competitors. The hypothesis is that the product portfolio of companies develops evolutionary. If a new product is successful on the market, it will remain within the portfolio. If it is not, it will be removed.

By comparing the portfolios of a high variety of competing companies successful products can be identified, because they turn up more frequently than poor performing ones. Products, that often can be found at portfolios of direct competitors, might fit into the own product portfolio more likely from a technical and an economical view. One objective of the method is identifying these opportunities and adding them to the own portfolio. Another objective of the method is identifying exotic products, which do not fit into the portfolio very well, and analysing whether these products are economically necessary or whether they can be dropped.

To find out, how often a certain product appears in different portfolios, one has to analyse the relationships between products and companies. If a company offers a product, it has a relationship with this product. If another company offers this product too, both companies have a relationship with each other via this product. As well products have a relationship with each other if they are offered by the same company. This basic methodological approach is illustrated in figure 2.

Products, which already are offered by the own company, can serve as initial points of investigation (e.g. products A, B and C of company A in figure 2). Subsequently, all companies shall be identified that offer these products too (e.g. company 2 and 3 offer product B too). Now products are regarded which are offered by these other companies but not by the own one so far. This way products are included into the investigation, which do not have a direct relationship to the original company (e.g. products D and E, which are offered by company 2).

Again, other related companies shall be identified (e.g. company 4, which offers product D as well). If a variety of products and companies is regarded, a real network of products and companies can be revealed. However, the above described strategic analysis rapidly gets very complex. One will be confused easily when regarding different portfolios on and on. Ultimately, it is difficult to compare the portfolios and to identify similarities between them without any analytical support. Thus, the analysis of portfolios should be supported methodically. By applying the method of the Design Structure Matrix (DSM) products can be easily linked to different companies and, respectively, to each other [Browning 2001]. Likewise, the network, which is represented by the DSM, can be visualised in a more convenient way. A graph-based visualisation tool makes it easier to understand the different relationships between products and companies. Both issues are discussed in the following section.

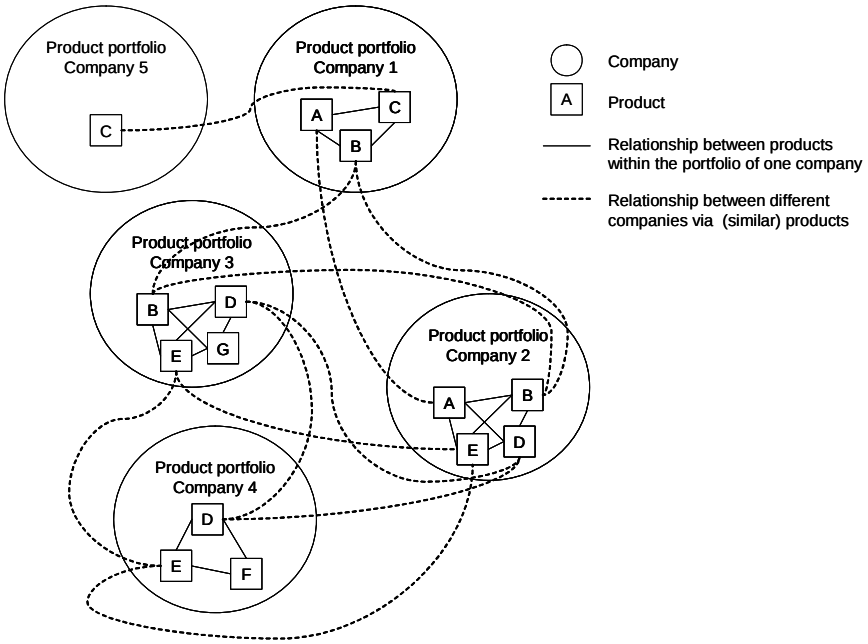

Figure 2. Basic approach of network portfolio analysis

2.1 Analysis of portfolios and visualisation of the resulting network

By the method of the Design Structure Matrix semantic relationships between different elements can be described. A semantic relationship in the context of network portfolio analysis means that a company offers a certain product. This semantic relationship is indicated by an "x" in the matrix. In Figure 3 company A and product 1 and company A and product 2 show semantic (company-product) relationships while company 2 has semantic relationships with product 2 and 3. Consequently, product 1 and 2 as well as product 2 and product 3 have semantic (product-product) relationships with each other, because they are offered by the same company. This is illustrated in Figure 3 on the right. As well, both companies have a relationship with each other as direct competitors as concerns product 2. Eventually, a so called semantic network results from the variety of relationships between companies and products. All relationships among and between products and companies are represented by this network.

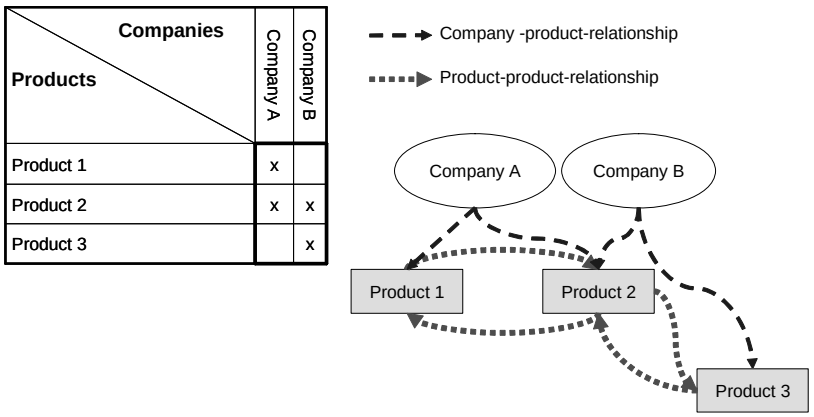

Figure 3. Visualization of relationships within a Design Structure Matrix

However, especially indirect relationships between products can not be identified easily within the Design Structure Matrix. The more companies and products are regarded the more difficult it is to comprehend the entire network and the complexity of its manifold relationships. E.g., while the relationship between product 1 and 2 can be made out easily in the DSM in figure 3 (same column), the indirect relationship between product 1 and 3 is not obvious. This relationship can be recognised more easily in the illustration of the network in figure 3 on the right. Here, the same information is visualised as it is in the DSM on the left. Elements, that are products and companies, are represented by rectangles and ellipses (so called "nodes"). Relationships – the "x" in the matrix – are represented by arrows (so called "edges"). This illustration of the elements and their relationships is called a "graph". By a graph relationships between elements can be made out much more intuitively compared with a Design Structure Matrix.
Maurer et al. have improved existing and developed new algorithms to analyse and visualise graphs to support the development of structurally very complex products [Maurer et al. 2004, Maurer & Lindemann 2004, Maurer 2006]. E.g., they developed a tool by that the degree of relationships between elements can be visualised through strength based graphs. Here, elements, that show a close relationship respectively a high variety of direct and indirect relations in-between, contract each other. On the other hand elements with only a loose relationship push each other. This way close-related elements build clusters that can be identified easily. Elements that are pushed by others locate themselves more remotely at the fringe. This effect is illustrated in figure 4 for the exemplary product structure of a ballpoint pen. Here, a cluster of close related parts can be made out in the centre, e.g. containing the case and the cartridge. The spring is a more isolated element (there is only one relationship between spring and cartridge), and is located at the fringe.

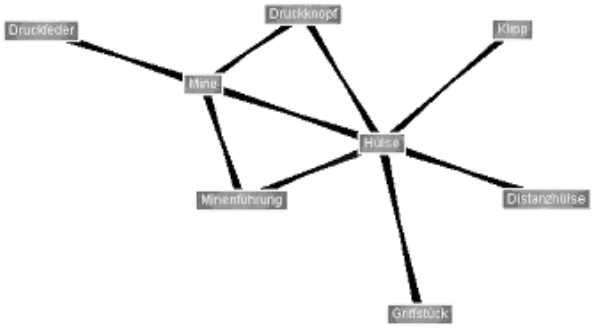

Figure 4. Example of a self arranging graph

Strength based graphs now can be utilised for illustrating the semantic network between the portfolios of different companies. If a certain range of products is offered by several companies, these products get a higher weight and attract each other in the graph. This way product combinations can be identified easily which turn up in the portfolios again and again. They are clustered within the visualisation of the network. As well, rarely appearing product-product-combinations can be identified. These products are rather exotic and located at the fringe. From a strategic view the products, that are clustered together, should be added to the own portfolio. More exotic products might be dropped or should be developed strategically. Furthermore, companies with very similar portfolios have to be regarded as direct competitors. But before going into further strategic applications of the network portfolio analysis in more detail, the process of establishing the portfolio network shall be described.

2.2 Process of establishing the portfolio network

The process of establishing the portfolio network is illustrated in figure 5. To begin with, all products, which are offered by the own company, are listed in the first column of a Design Structure Matrix (step 1). In the example in figure 5, the company C1 offers the products A, B, and C. In each case this fact has been indicated by an "x" in the second column of the matrix. Next, all companies shall be

identified which offer these products too (step 2). Usually, these companies are familiar, as they are the direct competitors. The investigation can also be supported by internet search, supplier catalogues, or yellow pages. In the example at hand, the companies C2 and C3 offer products of the same kind compared to company C1. These companies have been added to the third and the forth column of the matrix. Now, all products, which are offered by these companies but were not regarded in step 1, have to be added to the matrix (step 3). In the example in figure 5, the products D, E, and G have been added at additional rows. In step 4, again all companies shall be identified, which offer these additional products but were not regarded before (same to step 2). These companies have to be added to the matrix as well (C4 in figure 5). The matrix is now completed with products, which are offered by the last added companies (step 5, e.g. product F in figure 5). Iteratively, one has to go back to step 4 for any further additions. However, the matrix will become very large after only a few iterations. If the regarded product spectrum and the resulting portfolio network get too broad, one should cease from further iterations.

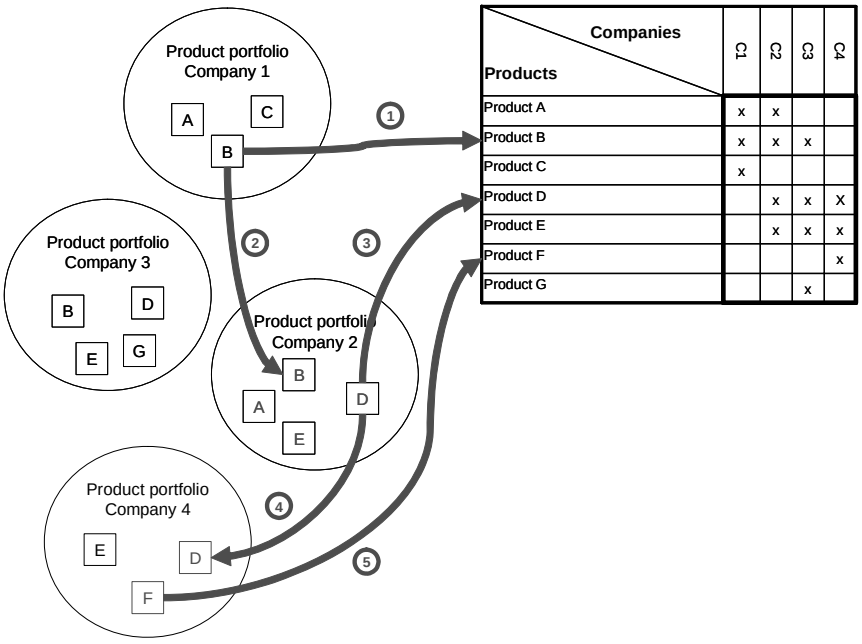

Figure 5. Process of network portfolio analysis

The establishment of the portfolio network can be supported by forming generic product categories, and thus creating different hierarchical levels. As well, a clearly defined nomenclature of the products is crucial, since products of the same kind commonly are named by the companies in different ways. The established company-product-matrix now has to be analysed using the above described method of strength based graphs. Possible strategic applications of that analysis will be introduced in the following section. Exemplary results of that analysis will be presented in the attached case study.

2.3 Strategic applications of the network portfolio analysis

The method of network portfolio analysis was developed for two applications within the context of strategic management:

- The visualisation of existing relationships between products and companies and
- the systematic search for new strategic opportunities.

By *visualising the existing relationships between products and companies* one can see which products are offered by the own company and how many respectively which companies do offer these products too. These companies are direct competitors. The analysis can be extended by regarding all products

of the direct competitors as well. This way, a map of the competition environment is drawn, in which manifold relationships between companies and products are visualised. Here, companies and products, which have close relationships to each other, are clustered together, while niche companies are located at the fringe. As well, the consistency of the own product portfolio can be assessed: All products which are arranged in clusters more likely fit into the existing portfolio.
The *systematic search for new strategic opportunities* is supported by the method as well. Here, only the direct and the indirect product-product-relations are regarded. Products with a close relationship to each other build clusters. Close relationships between products that are already offered by the company and products that are not yet offered indicate promising opportunities for strategic diversification of the own product portfolio.
Both views shall be explained with the following case study more clearly.

3. Case study

The presented method was exemplarily applied at a company, which produces home and commercial electrical equipment. The objectives of the project were finding new opportunities for product diversification as well as identifying product lines which does not fit well into the existing portfolio. The product portfolio of the regarded company has grown historically and contained several completely different product lines. A company-product-matrix was established as described above. After only two iterations 112 other companies and over 220 products were added to the matrix.
In figure 6 the relationships between products and companies are illustrated as a graph view. Easily, all products within the portfolio (blue coloured) and the competing companies in each case can be identified. As well, two clusters can be distinguished which represent two different product lines. The first cluster on the left is established by products of the regarded company which seem to fit together especially well. The cluster on the right is made up of only one product which shows various relationships to competing companies. Possible strategic implications from that visualisation might be to drop the isolated product on the right or to add other, appropriate products, thus extending the product line strategically.

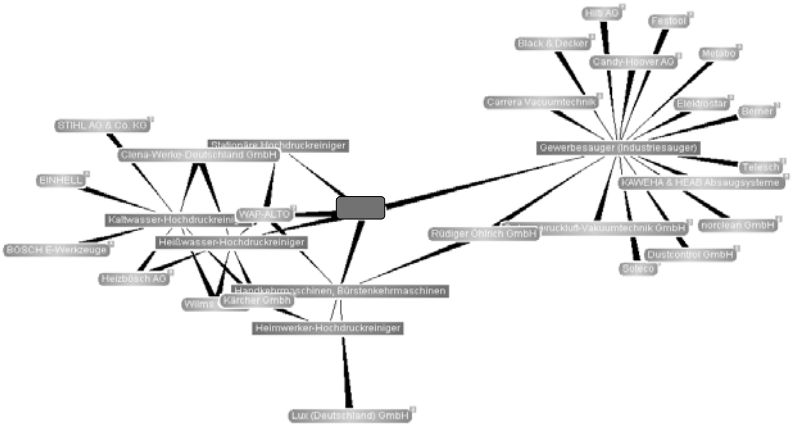

Figure 6. Product-company-network (first level)

If the products of the direct competing companies, and again related companies on the next level, are faded in as well, an extensive competition map can be spread. This network is illustrated in figure 7. Here, clusters of products and companies can be recognized even more clearly and in a broader view. Strongly related products are located in the centre while products of competing companies, which are only loosely or not related to own products, are located at the fringe. As well competition cluster of companies which have similar product portfolios can be identified. This visualisation of the competitors and their products helps companies to watch their competition environment. That way

new competitors as well as shifts in the product portfolios of competing companies can be made out easily.

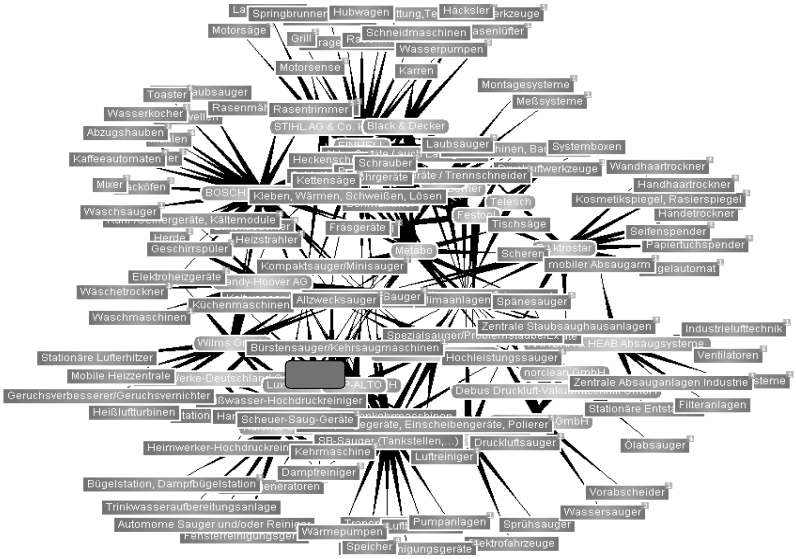

Figure 7. Product-company-network (competition map on a deeper level)

To find new opportunities for diversification of the existing portfolio, the product-product-relationships between the products have to be regarded. In figure 8 the relationships between an initial product – a high pressure cleaner – and other related products are shown exemplarily. Again clusters of strongly related products can be made out. E.g., vacuum cleaners, electrical heaters and electrical tools were identified as closely related products. These products might serve as promising starting points for a strategic diversification of the own portfolio. The development and market risk might be reduced because of the close relationship to already produced products.

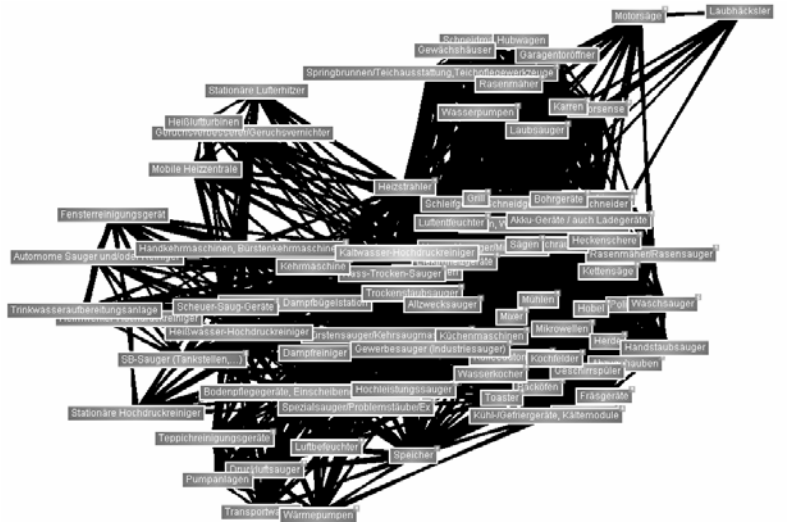

Figure 8. Product-product-network

By applying the method of network portfolio analysis in the presented project, new ideas for diversifying the existing product portfolio were found. As well, other strategic decisions were supported, e.g. to plunge certain products within the existing portfolio.
Especially, the systematic analysis of competitors and their products, the intuitive visualisation of the complex relationships, and the consistency of the results were decisive. This led to a high acceptance of the method itself and the results at the project partner.

4. Conclusions

The presented approach can be regarded as another useful method within the framework of strategic product planning and product development. It complements existing methods, such as scenario technique, portfolio analysis, or forecast methods, which are commonly applied here [Gausemeier 2001]. The introduced method supports an extensive strategic analysis and synthesis and helps to gain profound knowledge of the competition environment. When applying the method it was striking for the quality of the results that the nomenclature of the products was unequivocal. As well it was helping to structure the products on different hierarchical levels. However, it is important that only products on the same hierarchical level are regarded. Still, if the regarded level is too abstract on the other hand, results get less evidently and specific product ideas can hardly be developed.
The presented method is merely analytical – radical innovations should not be the intended result of the application. All strategic opportunities, that were discovered through the application of the method of network portfolio analysis, had to be evaluated, detailed and developed further in the context of the particular company. Yet, there is a remaining risk that product strategies of other companies only will be copied. There is also a risk that actually successful – and eventually necessary – products will plunged, only because they do not seem to fit into the portfolio. However, this should be regarded as the constitutional nature. For that reason all results of the analysis and following strategic decisions have to be weighted in-depth.

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