Innovations in traditional food products in small and medium-sized companies of the food industry. Review of literature

WP 7- Environmental, Societal, Human and Economic impact of innovation

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Traditional products and the economic impact of innovation

Prof. Dr. Klaus Menrad
Sandra Feigl

University of Applied Sciences of Weihenstephan
Science Centre Straubing
Schulgasse 18
94315 Straubing
Germany

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1. Introduction to the review

The food industry is one of the most important branches in the European Union with high relevance for economic output and employment. For several years this economic sector has been facing technical and economic changes in the production and processing of food as well as in society. Examples for these changes are new scientific and technical approaches in food processing, the effects of food scandals and socio-demographic developments (Menrad 2004 a). Thus innovations as an element of competition between companies of the food industry gain importance (Grunert et al. 1997). Innovations become more and more an instrument for companies in the food industry to stand out from competitors and fulfil consumer expectations (Menrad 2004 a). In the framework of the Truefood-Project[1] which is financially supported by the European Commission, the University of Applied Sciences Weihenstephan analyses the economic impacts of innovations on small and medium sized enterprises (SMEs) of the food industry. In this context a specific focus is devoted to innovations in traditional food products (TFPs).

The present literature review mainly targets on providing a theoretical and factual basis for the following empirical studies within the Truefood-Project. In the following the structure of the working paper on literature review is presented.

Chapter 2.1 shows the structure of the food industry in the European Union. As there is a specific focus on TFPs, the term TFP is defined in chapter 2.2. Chapter 3 gives a classification of innovations in general as well as some specific characteristics of innovations in the food industry. As a lot of new food products do not succeed at the market and are withdrawn within the first year after their introduction (Madakom 2001), it is very important to elicit factors which are responsible for success and failure of innovations. These factors which could be found in the current scientific literature are presented in chapter 4. According to many sources, interactions between food industry companies and external partners (e.g. supplying industries, end users, research institutes) play a crucial role for successful innovation activities (Menrad 2004 a). Thus in chapter 5 the current situation of co-operation of SMEs of the food industry is demonstrated.
Closing, the innovation effects on costs and profit are presented in chapter 6.

2. The food industry

2.1 Structure of the food industry

The food industry plays an important role in the economy of the EU (Roggenkamp 2002). In 2005 the total production value of the European food industry amounted to 836 billion € which equals to 13.6 % of the total manufacturing sector (CIAA 2006). The food and drink industry ranks first ahead of the automobile and chemical industry in Europe (Eurostat 2006). More than 3.8 million people were employed by the EU food industry in 2005. Some key figures related to the EU food industry are given in table 1.

Table 1: Development of key figures of the EU food industry from 2002 to 2005

	2002	2003	2004	2005
Production (billion €)	791	799	815	836
Added value (billion €)	178	181	-	-
Employees (million)	4.2	4.1	3.9	3.8
Number of companies	-	282.600	-	-

Source: CIAA 2006

France, Germany, Italy, the United Kingdom and Spain are the most important countries for producing food and drinks in the EU and account for about 70 % of the total turnover in the EU. In the year 2005 the companies in France produced food and drinks worth around 140 billion € ahead of Germany with a production value of about 133 billion € (CIAA 2006) (table 2). In terms of employees the German food industry (517,000 employees) was ahead of Spain (482,000 employees) and France (420,000 employees) (CIAA 2006). In 10 Member States of the EU the food sector is among the top three manufacturing industries in terms of value added. This fact shows the relative importance of the food and drink industry for EU national economies (CIAA 2006). Table 2 shows some data of the food industry by EU Member States.

[1] See website: www.truefood.eu

Table 2: Data of the EU food and drink industry by Member States in 2005

	Production value (billion €)	Number of employees (1,000)
Austria	9.9	58.5
Belgium	31.5	90.4
Czech Republic	9.4	131.4
Denmark	20.5	73.5
Estonia	1.1	16.7
Germany	133.6	517.0
Finnland	8.9	37.2
France	139.7	420.0
Greece	10.5	67.8
Hungary	7.5	113.4
Ireland	17.8	46.0
Italy	107.0	258.0
Latvia	1.3	35.3
Poland	-	-
Portugal	11.9	-
Slovakia	2.4	36.8
Slovenia	1.8	18.3
Spain	65.4	481.7
Sweden	15.2	58.7
The Netherlands	-	-
United Kingdom	-	-
Romania	5.3	172.0

Source: CIAA 2006

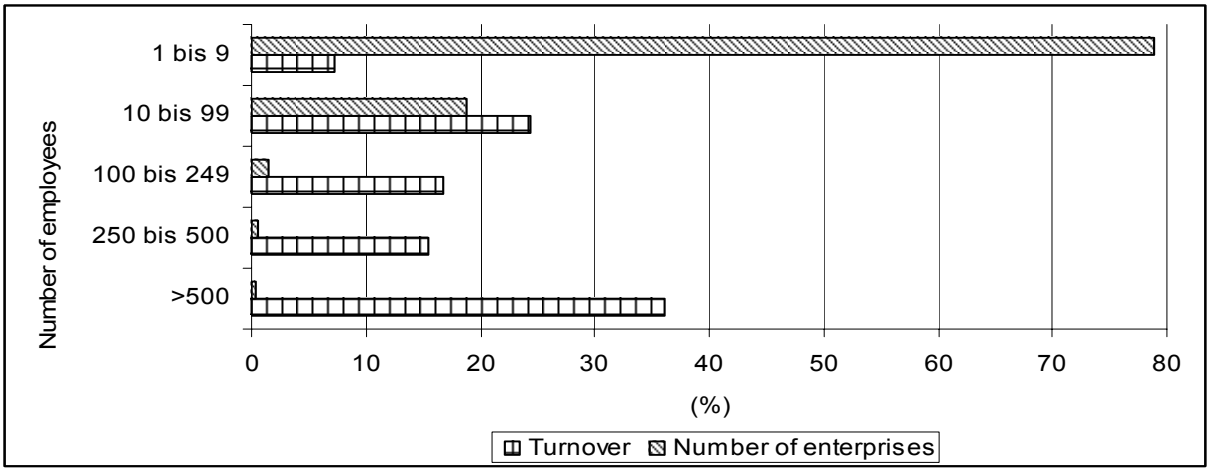
The food and drink industry is a diversified industrial sector with companies ranging from small and medium sized, often family-owned enterprises (SMEs), to major multinational companies like Nestlé or Unilever (Traill 1997). There is no general definition for SMEs in scientific literature. Different national and international institutions have their own definitions. This work is based on the draft of Recommendation 2000 of the European Union which is shown in table 3.

Table 3: EU definition of small and medium sized enterprises (SMEs)

Criterion	Size ranges	Recommendiation 1996	Draft of Recommendiation 2000
Employees (absolute number)	Very small enterprises	< 10	< 10
	Small enterprises	< 50	< 50
	Medium sized enterprises	< 250	< 250
Annual turnover (Million €)	Very small enterprises	undetermined	≤ 1
	Small enterprises	≤ 7	≤ 9
	Medium sized enterprises	≤ 40	≤ 50
Annual balance sheet (Million €)	Very small enterprises	undetermined	≤ 1.4
	Small enterprises	≤ 5	≤ 10
	Medium sized enterprises	≤ 27	≤ 43

Source: Own depiction on Weseloh 2004

Concerning the number of companies up to 99 % of the food and drink companies are SMEs in the EU (CIAA 2006). This relates in particular to Mediterranean countries like Spain and Italy (CIAA 2003). In 2001 nearly 79 % of the companies employed less than 10 workers. Only 0.4 % of the companies employ more than 500 people (figure 1). SMEs generate 47.8 % of the total turnover of the EU food industry (figure 1). Furthermore these companies employ 61.3 % of the sectorial workforce. However, large companies which account for only 0.9 % of all food companies provide 52.2 % of the turnover (CIAA 2006).



Source: Own calculations on the basis of Eurostat 2006

Figure 1: Distribution of EU-25 turnover and number of food industry companies according to size classes in 2001

Not only in terms of company size and ownership the food and drink industry represents a rather heterogeneous industrial sector but also in relation to the processed products. The distribution of turnover in sub-sectors of the EU food industry is shown in table 4. The most important categories in the food industry are meat-processing plants, which achieved a production value of 159 billion € in 2003, followed by the production of beverages (124 billion €) and dairy products (122 billion €) (CIAA 2006). The heterogeneity of the food and drink industry is illustrated by the fact that various food products represent a sector with a production value of 199 billion € in 2003. As main categories this group includes bakery, pastry, chocolate and confectionary products, but also a large number of other food products are summarized in this category.

Table 4: Turnover in sub-sectors of the EU food industry in 2003

Sub sector	Turnover (billion €)
Meat products	159
Fish products	20
Processed fruit and vegetables	59
Oils and fats	33
Dairy products	122
Grain mill products and starch products	31
Animal feeds	52
Beverages	124
Various food products	199
Total	799

Source: CIAA 2006

The most important food manufactures in the EU are shown in table 5. A high number of companies which are among the top 20 food manufactures in the EU are located in France, the United Kingdom and the Netherlands. In Germany and Italy only single companies and no Spanish company are among the companies in this list (table 5). Companies with the highest turnover (like e. g. Nestlé, Unilever) are active in multiple branches of the food industry, while companies which are only active in in one specific segment (e.g. dairy, confectioneries) rarely achieve a turnover of more than 5 billion € per year (CIAA 2006).

Table 5: Top 20 food manufactures in the EU (ranked by turnover in 2005)

Company name	Country	Food and Drink Sales	Sales in Europe	Number of Employees (1000)		Sector branches
		Billion €		Total	Europe	
Nestlé	Switzerland	58.8	17.8	253.0	69.1	Multi product
Unilever	The Netherlands/	37.7	16.2	206.0	49.0	Multi product
Heineken N.V.	The Netherlands	10.8	8.2	64.3	n.a.	Beer
Group Danone	France	13.0	6.5	88.0	32.2	Dairy products
Danish Crown Amba	Denmark	n.a.	6.5	n.a.	28.6	Meat products
Diageo Plc	United Kingdom	n.a.	5.6	n.a.	n.a.	Alcoholic beverages
Tate&Lyle	United Kingdom	n.a.	5.4	n.a.	9.3	Ingredients, prepared foods
Südzucker	Germany	n.a.	5.3	n.a.	19.9	Sugar, multi products
Associated British Foods	United Kingdom	8.8	5.2	75.0	75.0	Sugar, starch, prepared products
InBev SA	Belgium	11.7	5.1	77.4	n.a.	Beer, beverages
Group Lactalis	France	n.a.	4.9	n.a.	26.5	Dairy products
Carlsberg	Denmark	n.a.	4.9	n.a.	30.3	Beer
Scottish&Newcastle	United Kingdom	n.a.	4.8	n.a.	15.6	Beer, beverages
Ferrero	Italy	n.a.	4.6	n.a.	n.a.	Confectionery
Royal Friesland Foods N.V.	The Netherlands	n.a.	4.4	n.a.	16.4	Dairy products
Oetker Group	Germany	n.a.	3.6	n.a.	21.3	Multi products
Cadburry Schweppes Plc	United Kingdom	9.5	3.4	58.6	21.6	Beverages, confectionery
Bongrain	France	n.a.	3.3	n.a.	18.1	Dairy products
Campina	The Netherlands	n.a.	3.1	n.a.	6.8	Dairy products
Nutreco	The Netherlands	n.a.	3.0	n.a.	7.0	Meat products

Source: CIAA 2006

2.2 Traditional food products

As the term “traditional food products” (TFPs) is very complex and the scientific literature does not provide a general definition so far, it´s quite difficult to define this term. In the following different approaches for a definition which are stated in scientific and regulatory literature are provided and afterwards compared and discussed.

The Council Regulation (EC) No. 509/2006 (dated March 20th, 2006) defines the term “traditional” as follows: “Traditional” means proven usage on the Community Market for a time period showing transmission between generations. This time period should be the one generally ascribed to one human generation, at least 25 years” (European Commission 2006).
Furthermore Workpackage 5 of the Truefood-Project has developed a definition for TFPs as well. According to this definition, TFPs have to hold four different attributes (Truefood-Project 2006):

- The key steps of the production have to be local, national and regional. In this context this means that the product has to be produced in the own country. If firms start to produce in other countries, the food product is not regional anymore.
- The food product has to be “authentic”. That means the product has to fulfill at least one of the following attributes: The product has to consist of a authentic mix of ingredients and/or the origin of raw material what from the food products are produced has to be authetic and/or the process of production has to be authentic.
- Traditional products are for at least 50 years commercially available for the public in stores or restaurants. It might happen that during that period the food product disappeared from the market but it was on the market at least 50 years ago.
- The product has to offer “gastronomic hertitage”. This means the product must have a story which can be written down in 2 to 3 pages.

The definitions via the Council Regulation (EC) No. 509/2006 and Workpackage 5 of the Truefood-Project have in common that usage as well as availabilty on the Community Market is considered as being of high relevance for TFPs, even though the time period demanding is different in both definitions. As the usage on the Community Market is both offered in the definition of the Council Regulation (EC) No. 509/2006 and in the definition developed from Workpackage 5 of the Truefood-Project, this aspect seems to be quite important. So it should be definitely applied to TFPs. Regarding the demanding time period in which the product has to be on the Community Market, it seems to be sensible to pull up the recommendiation of Workpackage 5, namely 50 years, as Workpackage 5 developed a new definition of TFPs in particular for the Truefood project. All other criteria demanded in the two definitions are difficult to bring into operalization in particular in empirical surveys and

research. Therefore the key criteria used in this context will be the availability of food products of at least 50 years on the EU markets in order to be recognized as TFPs.

3. Character of innovations in general and in the food industry

In economy and in politics innovations are regarded as one of the central determinants for prosperity and economic growth. Taking into account the fast changing environment and framework conditions of the food industry, companies have to develop new strategies to keep pace with new developments like changing consumer behaviour and saturated markets (Weindlmaier 2001). The opportunity for realising corporate growth and extending market shares depends on the ability to introduce new products successfully on the market. Companies which are able to increase the number of successful innovations as well as to improve the effectiveness of their innovation process will win competitiveness (Cooper 1994).

3.1 Classification of innovations

3.1.1 Classification under the term of objection

One possibilty for classifying innovations is to systematise them under the term of objection. Generally it is distinguished between product innovations and process innovations. Furthermore organisational and social innovations are discussed in scientific literature.

Product innovations can be understood as the application of new production activities (Wegner 1991) which result in a new or essentially improved product which is introduced on the market and which offers consumer a advantage and a higher utility compared to products which already exist (Sabisch 1991). Important product innovation attributes are e. g. improving useful properties of the product, increasing of quality, changing of design and reducing environmental impacts (Pleschak and Sabisch 1996).

Process innovations are changes in the field of production which are applied within the enterprise (Hauschildt 1996). The changing of factor combinations can lead to a reduction of financial costs, improvement of productivity as well as a better quality of products (Pleschak and Sabisch 1996). Furthermore new production techniques can be developed which allow to realise new product innovations (Sneep 1996). Accordingly process innovations could be seen as an investment in skills, resources and competences of a company. The high pressure technology and the ultrafiltration technique are typical examples of process innovations which have been introduced during recent years in the food industry.

Quite often the distinction of process and product innovation goes hand in hand and is not always clear-cut (Weindlmaier 2001). One example for a product innovation which is linked with a process innovation is potato chips: The develpopment of the extruder technique was a condition for their production (Grunert et al. 1997; Weindlmaier 2001).

Organisational innovations better or modernise the administrative and process organisation of a company. Examples for this kind of innovations are a reduction of hierarchy levels and the solution of co-operation problems by “interface manager” (Pleschak and Sabisch 1996).

At least there are social innovations which concern changes in the field of human resources of companies, e. g. specific training for employees (Eherer 1994).

3.1.2 Classification under the term of profundity

Under the term of prufundity, i.e. under the degree of novelty, generally radical innovations and incremental innovations can be distinguished.

Radical innovations are characterised with a high degree of novelty. A product innovation is refered to be a radical innovation if it creates a new market as well as the innovator attains a (temporary) monopoly position. This kind of innovation often means complex changes in different fields of the innovating company, high financial expenditures (e.g due to intensive research and development activities) and a high market risk as these innovations pose a novelty both for the company and the market (Kotler and Bliemel 1999). These are the reasons why radical innovations are applied only discontinously and are rare in the food industry. One example for a radical innovation is the probiotic joghurt LC1 of Nestle which had been introduced onto the German market in 1996 (Wittkopp 2004).

Incremental innovations do not create a temporary monopoly position and have only a low degree of novelty (Bessau and Lenk 1999). Incremental innovations are often characterised by an improved benefit-cost ratio or improvements in the utility pattern for consumers (Pleschak and Sabisch 1996). According to Sabisch (1991) incremental innovations can be differentiated as follows:

Quasi-new products
Quasi new products are products which have been already existed on the market and differ in at least one characteristic feature from the existing product. As an example low fat margarine could be mentioned.

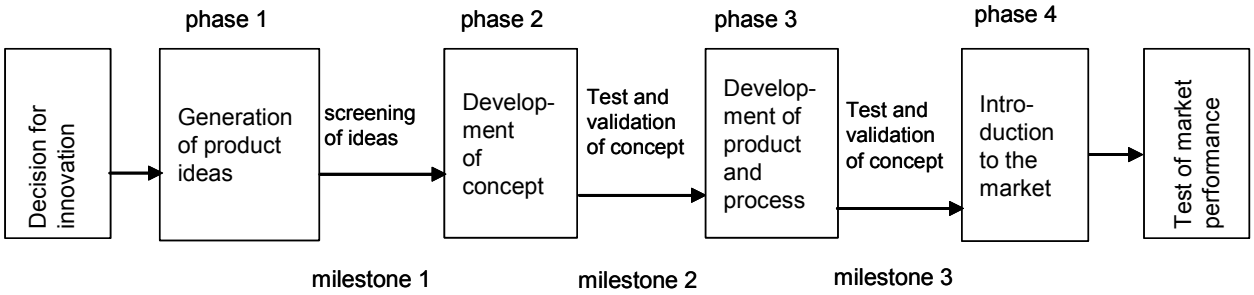
Me-too products
Me-too products (imitation product) represent a novelty only for the particular company. However, they differ only slightly from products which are already on the market. Me-too products are very frequent in innovations of the food industry.

For incremental innovations less technical application is needed what means a lower risk in product development (Kottler and Bliemel 1999). Due to the similarity to existing products synergies can be realised (Cooper and Kleinschmidt 1991). Accordingly it is possible to produce incremental innovations quicker and with lower financial expenditures. That is the reason why they are often applied in the food industry (Galizzi and Venturini 1996). Incremental innovations rather target on success for a short time period, while radical innovations are expected to provide success for longer periods (Tushman and O´Reilly 1997).

3.2 The innovation process

Innovation is a complex phenomenon, involving the production, diffusion and translation of scientific or technical knowledge into new or modified products and services as well as new production or processing techniques. Different models for the innovation process can be found in scientific literature. Two general models, namely the sequential or linear model and the integrative model, are described in the following chapter.

Until the 1980s, the idea of a linear sequential model of the innovation process prevailed in innovation research which is shown in figure 2. According to this model, the innovation process starts with basic research which tries to analyse the scientific principles of a specific phenomenon without a specific target. This phase is followed by applied research which intends to find solutions for defined problems or targets. The successful results of this process ("inventions") are transferred into the experimental development phase aiming to develop e. g. a prototype of a new product. Successful prototypes are transferred to industrial development and finally to the production process. Afterwards follows the market introduction and – in case of success – the market penetration of the new products. In the linear model it is assumed that there are no reciprocal interactions between research institutions and industrial research, but a linear transfer of results of basic research activities to industrial companies (Menrad 2004 a).

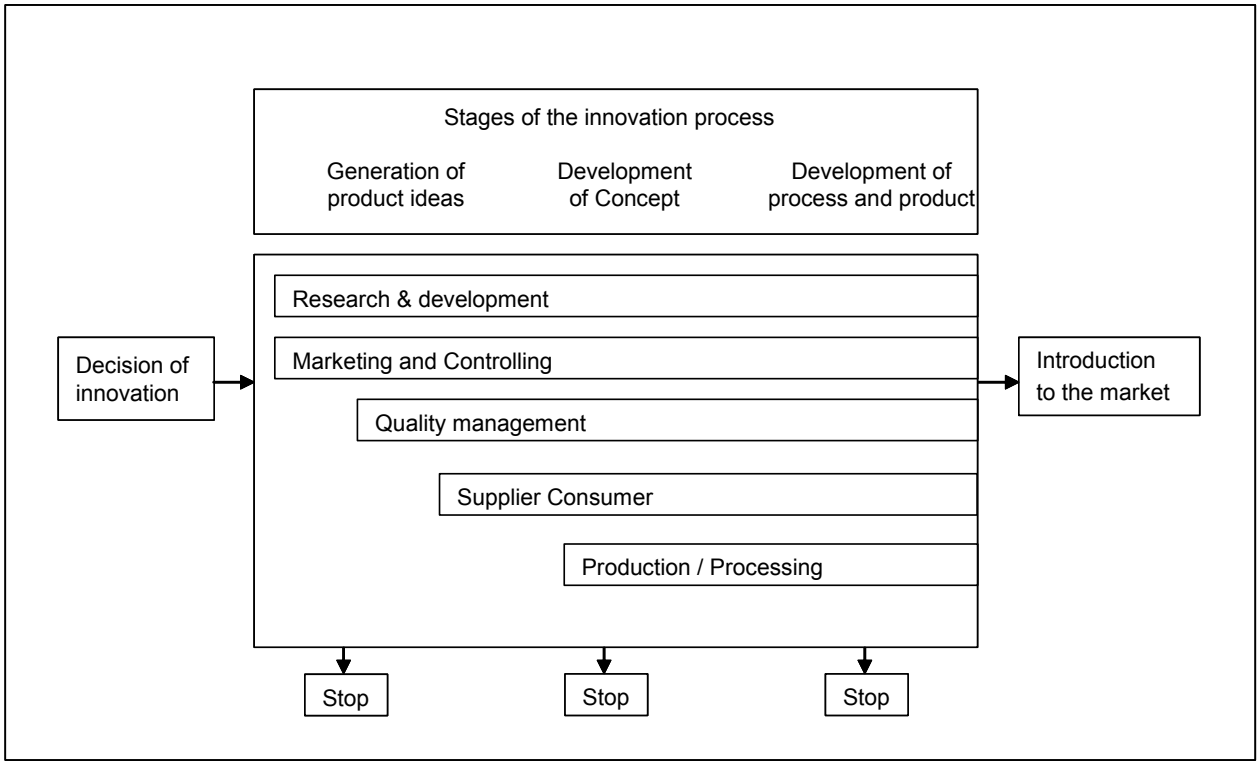


Source: Stockmeyer 2001

Figure 2: Sequential model of the innovation process

As there were some criticisms on the linear model of the innovation process, like e.g. that there is no feedback mechanism between the different phases (Dosi 1982) or that factors outside industrial companies are not considered in the model (Senker 1995) during the 1990s, the integrated model has been introduced in scientific literature (figure 3). This model is characterised by networking and recursive interactions between the various stages of the innovation process and different types of

actors, parallel developments in science, strategic integration of partners (e.g suppliers, customers) and the use of co-operations in order to overcome limitations during the innovation process or for reducing time-to-market and the generation of knowldege based on the principles of division of labour (Menrad 2004 a). Generally it can be concluded that innovations are characterised by complicated feedback mechanism and interactive relations which involve science, technology, learning, production, policy and demand (Edquist 1997).



Source: Weindlmaier 2001

Figure 3: Integrative model of the innovation process

3.3 Character of innovations in the food industry

Traditionally the food industry is regarded as a sector with low R&D intensity (Martinez and Briz 2000; Grunert et al. 1997; Christensen et al. 1996). However, innovations are an important instrument for companies in the food industry to stand out from competitors and to fulfil consumer expectations.

An important source of innovation activities are internal R&D departments of industrial companies. However, there is no statistical information available concerning the personnel or financial resources devoted to R&D activities of the EU food industry. Therefore, for illustrating the specific character of innovation activities in the food industry the example of Germany is used. In Germany, R&D personnel of the food industry peaked in 2001 with around 2,776 people and decreased to 2,474 in 2003 (BMBF 2006). In 2003 the food industry in Germany spent around 261 million € for R&D activities (BMBF 2006) and was responsible for 0.7 % of all funds devoted to R&D activities of the German industry compared to 5.4 % regarding turnover and 3.7 % regarding employees (BMBF 2006). Consequently the R&D intensity[2] of the food industry is frequently one of the lowest among all industries (BMBF 2000, 2002). In 2003 the R&D intensity of the food industry reached 0.6 %[3] compared to 4.2 % in all industries in Germany (BMBF 2006). This low R&D intensity is supported by the EU CIS survey of 1996 in which the food and beverages industry had the lowest R&D intensity of all industrial branches of the manufacturing industry (Eurostat 2000).

Despite the low R&D intensity of the food industry in the European Union, relatively high differences among the companies are notable. It can be observed in company surveys that generally less than 20 % of the companies spend more than 1 % of their turnover on R&D activities. Oftentimes, to this

[2] Percentage of R&D expenses related to the turnover of an industrial branch.
[3] Only the turnover of those companies is considered which carry out R&D activities.

group belong large food multinationals (like e. g. Nestlé, Unilever) (Weindlmaier 2000) what is also shown in table 6. On the other hand, around 20 % of the companies do not carry out R&D activities (Teuscher 2000, Weindlmaier 2000). In addition, surveys among companies indicate that at least a part of the SMEs totally lack R&D personnel (Teuscher 2000, Stockmeyer and Weindlmaier 1999; Weindlmaier 1998).

Table 6: R&D expenditure of multinational enterprises of the food industry

Enterprise	Year	Turnover in Million €	R&D expenditure in Million €	R&D expenditure (in % of turnover)
Unilever, NL/UK	1999	45,531	985.1	2.1
Nestlé, CH	1999	46,541	556.4	1.2
Philipp Morris, USA	1999	73,743	489.8	0.7
Danone, F	1999	13,292	122.3	0.9

Source: Stockmeyer 2001

There are several explanations for the low R&D spendings in the food industry. In most of the food companies basic research activities play only a minor role or they are not carried out at all. Furthermore, many innovations are derived from other input sectors being incorporated in machinery, packaging and other manufacturing supplies. The same applies to the producers of food ingredients which often belong to the chemical industry (Menrad 2004 a). These are also the reasons why the number of innovations (in term of new products) of the food industry is quite high, in spite of low R&D spending. Another explanation for the low R&D-expenditures is that SMEs - which amount the highest part in the food industry - often do not dispose of adequate personnel and financial resources for R&D activities (Schmalen 2004). However, low R&D spending in SMES might have negative effects on their future competitiveness (Weindlmaier 2001).

Innovation activities in the food industry can be analysed with differing methodological approaches and on different levels. However, there are high variations in the published figures concerning the number of new products in the European food industry. According to the CIS survey around 50 % of the EU food manufacturers in 1996 can be regarded as "innovators" (Eurostat 2000).

There are also big differences concerning the published numbers of “new” food products. This issue can be illustrated for the example of Germany. Investigations which are based on the EAN code of the products[4], counted almost 21,000 new food products in 2001 (Madakom 2001). Other studies which try to consider products with a higher degree of novelty found much lower figures. For the years 1993 and 1994, 1,662 product innovations have been recorded in the German food industry with great differences between the various industrial branches (Hermann 1997; Hermann et al. 1996). According to investigations of the food journal Lebensmittel-Praxis the number of newly launched food articles decreased from around 1,300 in the mid 1990s to around 1,050 products at the end of the decade (table 7). The highest number of new products was registered in beverages, confectionery, snacks, dairy products and frozen food.

[4] In such surveys each product with a new EAN-code are considered as an “innovation”, i. e. each modification e. g. in the packaging or other minor changes in the product design leading to a new EAN-code and thus to a new product.

Table 7: New food products in Germany 1995 to 2000

Product group	1995/96	1996/97	1997/98	1998/99	1999/00
Beverages	234	308	207	216	173
Confectionery, snacks	216	209	190	170	188
Dairy	241	190	139	157	120
Frozen food	160	187	110	108	119
Meat, poultry	101	84	87	77	76
Delicacies	63	65	69	55	49
Pre-prepared products	53	52	24	41	45
Animal feed	28	13	37	69	24
Bread, bakery	27	28	22	28	29
Cereal products	43	52	66	65	80
Dietary products	40	36	31	32	29
Sauces, spices	31	26	22	24	17
Baby food	44	33	48	66	49
Fish	15	17	15	16	8
Fruit and vegetables	23	33	19	21	27
Cereals	-	-	-	-	19
Total	1,316	1,333	1,096	1,145	1,052

Source: Deutscher Fachverlag 2001

The market research institute Datamonitor continuously collects information about product innovations in the food industry in more than 50 countries. An overview about the product innovations in Germany collected by this institute between mid 1999 and mid 2001 is given in table 8. During this period 1,579 new food products were introduced in the German market. This figure is slightly lower than those collected by Lebensmittel-Praxis (taking into account a 2-year period), but can be explained by the absence of some product groups (e. g. meat, fish, fruits, vegetables) in the Datamonitor data. The highest number of product innovations was observed in dairy, confectionery and non-alcoholic beverages (table 8), underlining the findings of the other studies. Around 56 % of the product innovations of 1999 to 2001 have been launched by large companies with more than 500 employees (table 8). Regarding the different food categories, large companies showed a high relevance in innovations in baby food, sauces, frozen food and dairy products, whereas SMEs had a specific relevance in innovations in all types of beverages (table 8).

Table 8: Product innovations in Germany 1999 to 2001

Food category	**New products**		Large company		SME	
	Number	in %	Number	Proportion	Number	Proportion
Baby food	44	2.8	44	100.0 %	-	-
Dairy	250	15.8	156	62.4 %	94	37.6 %
Bakery	197	12.5	113	57.4 %	84	42.6 %
Pasta and rice	19	1.2	10	52.6 %	9	47.4 %
Confectionery	250	15.8	135	54.0 %	115	46.0 %
Canned food	50	3.2	27	54.0 %	23	46.0 %
Chilled food	69	4.4	41	59.4 %	28	40.6 %
Frozen food	157	9.9	115	73.3 %	42	26.7 %
Sauces	52	3.3	39	75.0 %	13	25.0 %
Snacks	42	2.7	22	52.4 %	20	47.6 %
Hot beverages	67	4.2	25	37.3 %	42	62.7 %
Non-alcoholic beverages	228	14.4	104	45.6 %	124	54.4 %
Beer	97	6.1	32	33.0 %	65	67.0 %
Alcoholic beverages	57	3.6	23	40.4 %	34	59.6 %
Total	1,579	100.0	886	56.1 %	693	43.9 %

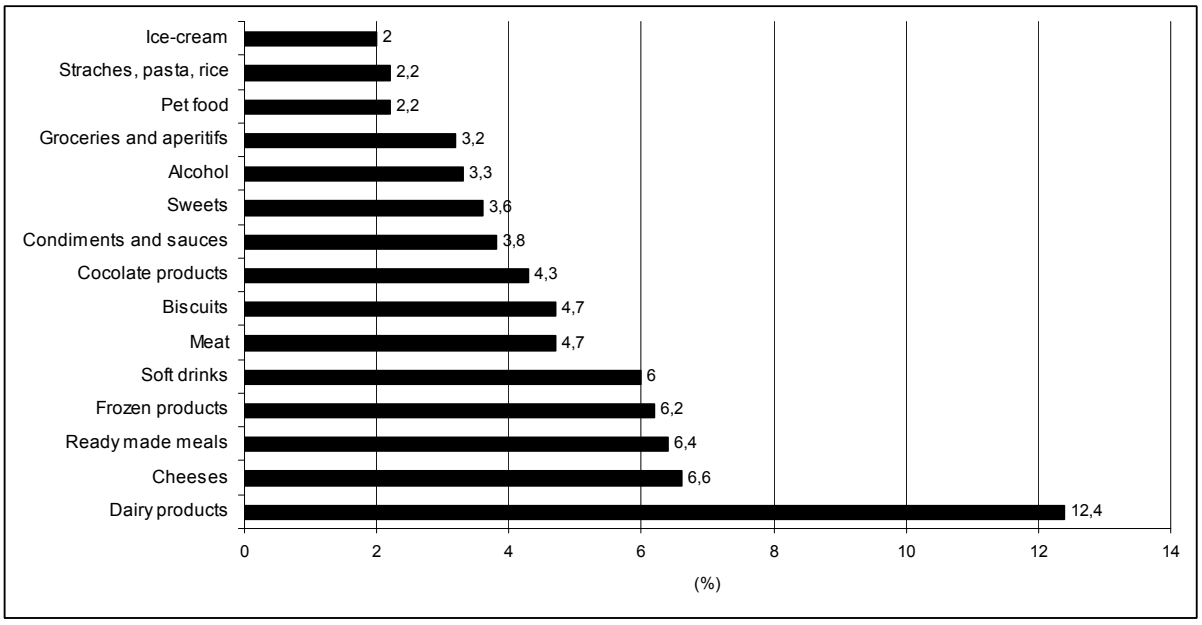
Source: Menrad 2004 a

The same discrepancy in the number of new food products which was illustrated for the German market also can be found in the USA. The specialised magazine *New product news* (Dornblaser 1998)

reported that the number of new food products which have been introduced in 1995 and 1998 in the USA ranged from 13,000 to 16,000 food products. On the other hand, Marketing Intelligence Service Ltd. found out that of around 11,000 new food products which have been introduced in the US market in 1996 only 7.2 % featured innovations in formulating, positioning, technology, packaging or creating a new market (Messenger 1997). Ernst & Young found that instead of the more than 15,000 new food products, which are reported annually by *New Product News*, only 1,100 to 1,200 new products are introduced each year in the US food market, of which 22 % are new brands and 78 % are line extensions (Lord 2000). Using an even more narrow definition of new products than Ernst & Young, a list of 440 new products introduced in the US market have been found by the 1996 Pacesetters report (Menrad 2004 b). Of these 440 new products, 85 % were considered line or category extensions and 15 % featured new brand names. Some details concerning product sales after market introduction have been given by the 1996 Pacesetters report as well: Innovative products averaged 63 million US$ in first-year sales and non-innovative products averaged 28 million US$ (Menrad 2004 b).

The Confederation of the food and drink industries of the EU (CIAA) collects information about product innovations of the food industry in Europe. An overview about the 15 most innovative categories of the food industry in the year 2003 is given in figure 4. Dairy products are the leader in the number of innovations (12.4 %), followed by cheese (6.6 %) and ready made meals (6.4 %) (see figure 4).

Figure 4: The most innovative categories of the food industry in Europe (share %) in 2003



Source: CIAA 2004

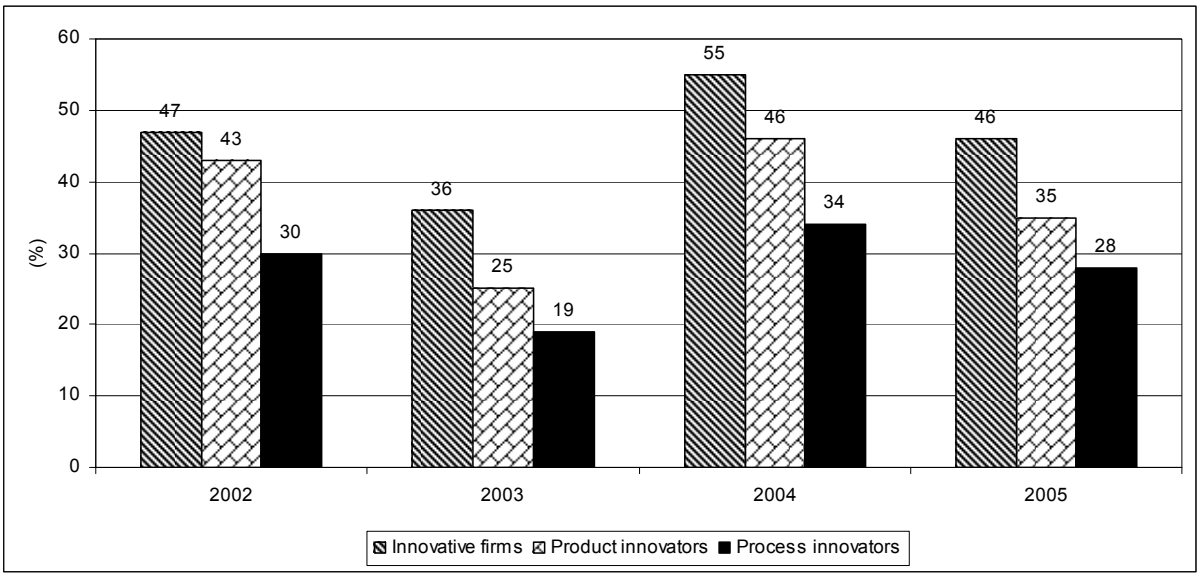
Given the high number of product innovations in the food industry it is not surprising that a relatively high percentage of the newly introduced products only “survive” a limited period of time in the market and fail after this period. During 2000 and 2001 around 50 % to 67 % of the new products have been withdrawn within one year from the food retailing shelves in Germany. After three years the “survival” rate of the new products tends towards 25 % (Madakom 2001). Studies from Ernst & Young and AC Nielsen (1999) and Booz, Allen & Hamilton (1992) also show that there is a notabel high rate of new introduced products which does not succeed at the market. Other authors support this high rate of product failure in food retailing as well (Martinez and Briz 2000; Behr's Verlag 2002). This issue is mainly caused by limited sales and shelve areas in food retailing and in tendency saturated food markets with low total growth rates in the EU.

High failure rates of launched food products also can be found on the US market. The 1996 IRI Pacesetters report calculated that approximately 72 % of new products and 55 % of line extension fail (Menrad 2004 b). Another study which analysed the introduction of new products of 20 major US food companies in 1995 found that of the 1,935 new products introduced by these companies 1,761 were line extensions and 174 were “new”. New items experienced a success rate of 52 % while line extensions had a 78 % success rate what equals to an overall success rate of 76 % (Lord 2000). Besides, severas studies in the US concluded that bigger US food companies seem to have higher success rates than smaller companies (Lord 2000; Dornblaser 1997).

Company surveys are another source of information about innovation activities of the food industry. Based on an investigation of innovation activities of the processing industries in Germany, a decline in the percentages of innovative firms, product and process innovations was registered in the food industry in the year 2003 compared to 2002. After a strong increase in all types of innovation activities in the year 2004, a decline of percentage of innovative firms, product and process innovations is observable in the year 2005 (see figure 6). The proportion of innovative firms in the food industry reached 46 % in 2005. In the same year, 35 % of of the surveyed companies launched product innovations respectively 28 % launched process innovations (ZEW 2006).

Stockmeyer and Weindlmaier (1999), who reported that 80 % of 265 companies surveyed have launched at least one new product within recent three years, supported the high relevance of product innovations. In Germany, as a general tendency, the proportion of companies with product innovations tends to increase with the number of employees (ZEW 2000, 2001). The relevance of food companies with process innovations decreased from 57 % in 1998 to 40 % in 1999. Until the year 2005 the percentage of process innovators continously decreased to 28 % (ZEW 2006). The proportion of companies realising process innovations strongly increases with the number of employees, from 19 % below 49 employees to 66 % in companies with more than 200 employees (ZEW 2001). The combined use of product and process innovations can be regarded as another characteristic feature of innovation activities in particular of SMEs in the food industry (Traill 2000).

Figure 5: Innovation activities in food industry companies 2002 to 2005



Source: ZEW 2006

The main targets of product innovations of food SMEs are focused on market as well as demand-oriented issues. This relates to a better penetration of new products in existing markets, to the opening of new markets and the improvement of the image and the design of the products. Product innovations of food companies are often focussed in application fields which are familiar to the companies. For this purpose, existing products often are improved and further developed.

The targets for process innovations of food companies are wide-ranging, without a specific focus on a particular field. Besides the improvement of product quality, higher flexibility and faster production processes, cost-saving aspects (e. g. decrease of production costs, reduction of material/energy use), as well as improvement of the working conditions for employees were regarded as major targets by the respondents of company surveys (ZEW 2000, 2001). In addition, the results of a company survey in Germany indicate that the companies mentioned technical aspects (like purchase of licences or technical equipment) as less relevant while modifications in the organisation of working processes (82.3 % of the respondents assessed this factor as “very relevant” or “relevant”) and training of employees (78.5%) were regarded as most important prerequisites for successful process innovations (Menrad 2004 a).

According to the survey results of ZEW in 2001, 10 % of the turnover of the companies have been achieved with products which have been introduced in the last three years (ZEW 2001).

For the Spanish food industry around 70 % of the companies reported in a survey that new products which have been launched between 1993 and 1995 accounted for less than 25 % of total turnover (Martinez and Briz 2000).

The high relevance of product innovations as well as the combined nature of product and process innovation is a characteristic of the food industry in other EU countries as well. Martinez & Briz (2000) found for the Spanish food industry that almost 75 % of the 54 companies which have been surveyed introduced combined product-process innovations. In a survey among European food-manufacturing firms in 1996/97, strong evidence was found that R&D expenditures were closely correlated with the development of new products (Traill and Meulenberg 2002). In a study which analysed the innovation strategies of the largest industrial firms in Europe (so-called PACE survey), product innovations have also been considered more important than process innovations in the food industry (Arundel et al. 1995).

Several studies have shown that radical innovations are very rare in the food industry. Most innovations in the food industry can be characterised as incremental innovations or even imitations (Grunert et al. 1997). According to a study by A.C. Nielsen, only 3.7 % of the new products which have been introduced in 1996 and 1997 in the German food market, were assessed as truly "innovative", while 80 % were regarded as me-too products (Behr's Verlag 2002). Similar results have been found in a study of the University of Göttingen, in which only 3 % of the product innovations in the German food industry were described as "truly innovative" and were also reported for the US and the Spanish food industry (Gallo 1995; Connor and Schiek 1996; Martinez and Briz 2000). Galizzi and Venturini (1996) reason the incremental nature of food product innovation to constraints on the demand side. European consumers are conservative in their food choices and may initially reject new products. For this reason, fundamentally radical innovations are a high risk for food manufacturing companies. As changing consumer taste and requirements have become the main drivers for the expansion of the EU food industry (Christensen et al. 1996), companies mainly react by introducing new food products whose characteristics are generally only incrementally different from existing ones.

4. Success factors of innovations in the food industry

Product innovations are vitally important for the competitiveness of food industry companies. However, the failure rate of innovations in the food industry is quite high as shown in chapter 3. Thus it is very important to ascertain factors that yield to success. However, the term "success" holds very differing parameters (Schmalen 2004). Financial parameters (e.g. market share, growth in sale) are dominating for measuring the success, but also emotional or qualitative parameters became more important in recent years. The assessment of success with regard to the consumers (e.g. consumer satisfaction and utility) and to the process development is of high importance as well (Griffin and Hauser 1996).

Success factors indicate the essential, long-term valid determinants for the acruement of success or failure of an activity (Schmalen 2004). According to literature there is no single "magical" factor which is responsible for success or failure of innovations but only the interaction of many influencing variables can explain success or failure of new products (Perlich and Staerkle 1987). However, the absence of one important success factor can be the reason for failure (Cooper 1980).

Success factors and reasons for failures of innovations have been analysed by numerous scientific and empirical studies in recent years. Not only the food industry but also other branches are considered when analysing scientific literature. According to the analysed literature, success factors of innovations can be identified in the following fields.

- Situation and perspective of the market
    - The grade of concentration
    - The target market
    - Time-to-Market strategy
    - Pricing strategy
- Market research and marketing
    - Effective market analysis
    - Quality of marketing actions
- Role of food retailers
- Enterprise size and form of enterprise

- Innovation management
    - Attitude of the management towards innovations
    - Internal organisation within the company
    - Co-operations with external partners
    - Resources for innovations
- Future developments in science and technology
- Product characteristics
    - Product advantage
    - Degree of novelty
    - Product concept
    - Product defects
    - Synergy effects

In the following the single success factors are analysed and described according to the defined categories.

Situation and perspectives of the market

Like mentioned in chapter 3 innovations can be differed in technology-push and market pull innovations. After a long-running and intensive discussion most authors in scientific literature assume that a typical innovation process is both technology- and market-driven (Stockmeyer 2001). However, within the food industry it can be observed that most innovations are market driven in recent years (Stockmeyer 2001).
Parameters referring to the market of food products are important factors with respect to innovation success. Often in particular SMEs are not able to directly influence the market situation and developments but these are determined by a lot of differing external factors. Many authors regard the attractiveness of the market as an casting success factor. The attractiveness of the market is often described with the term “market potential”. This factor contains the market size, the growth potential, the importance of the products for the consumers as well as the acuteness of consumer needs (Cooper and Kleinschmidt 1987; Kotzbauer 1992).

The grade of concentration

Concerning the market, the grade of concentration of suppliers can be seen as a determinante of success. If the number of suppliers is growing, the grade of concentration is decreasing and vice versa (Roggenkamp 2002).

Different theories have been developed regarding the consequences of the grade of concentration on a market and the innovation behaviour of companies. Firstly, the Neo-Schumpeter-Hypothesis has been developed which argues that there is a higher motivation for innovation in a monopoly situation compared to perfect competition (i. e. in a polipolistic market) (Pfähler and Wiese 1998). The following reasons are mentioned in scientific literature in favour of this theory: Due to monopoly profits there are better possibilities for self-financing for innovative projects for large and market-power enterprises. Furthermore, it is easier for large companies with high turnover to invest some capital in innovation projects and also obtain additional financial resources on the capital market. Large enterprises also are characterised by higher innovation activities due to economies of scale in R&D. For using these, the R&D-departments have to be of a certain size. Such economies of scale in R&D can just be realised with an adequate turnover of the company. In addition, big R&D departments yield agglomeration diseconomies, i.e the creativity of a researcher is increasing due to interacting and co-operating with others. Yields of R&D are higher if it is possible to distribute the fixed costs of innovations over a high number of sold products. Thus large enterprises with accordant product capacities are advantageous. As the co-operation with the different departments of the enterprise is developed in a better way, R&D is more productive in large enterprises (Roggenkamp 2002).

In contrast, the hypothesis of Arrow argues in another way. According to this theory an increasing number of providers attends an increasing innovation activity. Thereby it is argued that a company in a polypoly has got a higher marginal revenue than a company in a monopolistic competition, as process innovations leads to a decrease of the market price in the case of monopoly. This is not the case in a polipolistic market in which the introduction of an innovation yields a short-term monopoly. The innovative enterprise is able to skim the monopoly profit so that the motivation for innovation is high in such a situation (Roggenkamp 2002).

For Kantzenbach (1966) the oligopoly ist the most innovative type of market as this is the type of market with the highest level of competition. In the polypoly long-term profits are quite low in average if there are any at all. Thus companies only can realise innovations if external money can be acquired what causes specific problems in SMEs resulting in a low number of R&D and innovation projects in such companies (Roggenkamp 2002). According to Kantzenbach (1966), the intensity of competition is increasing due to the decreasing number of providers of a specific good in an oligopoly situation. In parallel, the room for internal and external financing of the market participants is enlarged what can be used amongst other activities for innovations (Kantzenbach 1966).

So far the scientific literature does not agree about the most adequate type of markets in order to promote or facilitate innovation activities (Roggenkamp 2002). According to Schmalen (2004) who interviewed 632 companies of the food industry in Germany in which the bigger part (80 %) are SMEs, more tops are introduced in growing and dynamic markets (Schmalen 2004).

The target market

Regarding the optimal target market there are different strategies. On the one hand a broad target market could be a success factor, so it is worthwile to reach a high grade of distribution (Schmalen 2004). The presence to the consumer is quite high due to a high grade of distribution. Actual studies show that products often fail which have not reach a distribution of more than 35 % of the average turnover in the 20th week after launching a new product. In contrast to non-successful products, successful products oftentimes are already provided to large-scale consumers (like e.g. schools, gastronomy, diners) in the phase of introduction (Schmalen 2004).

On the other hand it also can be successful to concentrate to niche markets (Cooper 1979). Thereby it is very important to realise the needs of specific target groups via a professional market research and transfer into innovative product concepts. An active analysis of target groups contains an analyis of consumer needs, trends and market niches` searching (Schmalen 2004).

Roggenkamp (2002) alludes that fragmented markets are occurring due to intensive competition on the supply side. Thereby companies have to consider small market segments instead of mass markets. This causes less sales volume and less profit of each individual product (Roggenkamp 2002).

The time-to-market strategy

The timing of the market entry can decide on success or failure of a innovation. In some studies the time of market entry is indicated as a main reason for stopping an innovation project (Plewe 2001).

Regarding the optimal time of market entry no general statement is possible as different factors influence the optimal time of market strategy. There are different options for the timing of market entry:

- First-to-market strategy (the company brings a real innovation onto the market as a pioneer)
- Early-to-market strategy (the company follows the pioneer in a early stage before the market is growing intensively)
- Me-too strategy (the company enters the market in the phase of growing) (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000).

Bevore deciding the time of market entry both tactical and strategical reflecting have to be considered by the companies. During this process the following aspects should be considered for example (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000):

- Grade of innovativeness of the new product
- Stock situation if a new product is substituting an already existing product of the company
- The seasonal sale structure (if this is given in the target market)
- Expected behaviour of competitors

A leading position against the competitors can be built up by applying the First-to-Market strategy. That is an advantage of this strategy. Furthermore entry barriers for competitors can be built up and there might be some flexibility regarding the pricing strategy due to the “quasi-monopoly” situation. However, companies applying the First-to-Market strategy have to create consumer needs and carry the expenditures for establishing the market (e.g. expenditures for communication and information) for their own what can include a substantial investments and a high risk for the company (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000).

If the market entry is strategically planned, companies which applicate the Early-to Market strategy could have similar chances like the pioneer but less risk and costs. Furthermore the pioneer has advertise the problem solving on the market. However there are also disadvantages of the Early-Market-strategy as. e. g. entry barriers of the pioneer have to be overbeared by following companies (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000).

If companies enter the market which stands already in the growth phase, market rules and relations already have been developed, standards have been definded and knowledge about consumer behaviour is available. One major disadvantage of the Me-too strategy relates to the fact that companies which apply this strategy have to geared to the competitors and thus they have just a restrict room for manueuvre on the market (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000).

The pricing strategy

Similar to the optimal timing of market introduction, there are different strategies regarding the optimal pricing of innovative products. Either the high-price-strategy nor the low-price strategy can be identified as an explicit success factor. Depending on the requirements and aims of companies both strategies could lead to innovation success. The aim of the high-price strategy is to skim variable willingness to pay in different phases of the life cycle of a product (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000). Requirements for a successful high-price strategy are (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000):

- Low risk for competition in case it is difficult to imitate the product
- Distribution via marketing intermediaries with high-price-strategy
- Well funded target group rewarding special benefits of the product with higher prices
- Products with special USP

If the low-price strategy is applied, a swift market penetration is aimed. In aid of a higher output a minor unit profit is accepted. Requirements for a successful low-price-strategy are (Nieschlag et al. 2002; Kotler and Bliemel 2001; Meffert 2000):

- Products with a highly price-elastic demand
- Distribution via price aggressive marketing intermediaries
- Buying power of low income customers can be skimmed
- The competition should be kept (at least a short time period) from the market introduction or rather be squeezed out of the market

Because of the meaning of the market for the process of innovation interfaces and instruments for involving of internal and external acteurs are very considerable. Thereby deficits mainly consist in the co-ordination between marketing and R&D activities and departments (Stockmeyer 2001).

Market research and marketing

Effective market analyses and consumer communication

Central prerequisites for the innovation success especially in the food industry are market research and marketing activities. An effective market analysis which contains knowledge of requirements, price sensitivity and buying behaviour of consumers impacts the success in a positive way. The relevance and shaping of these factors have to be inspected continously as it is possible that they change during the innovation process (Rothwell et al. 1974).

Quality of marketing activities

A critical success factor can be identified in the field of marketing. The results of Schmalen (2004) show that the planning quality of marketing actions is quite important regarding the success of innovation projects. This applies in particular to a specific education and Kno-how expertise of the involved personnel as well as intensive communication among the participating groups and institutions (Schmalen 2004).
Many SMEs have limited financial and organisational resources. For this reason they often opt for low-cost marketing strategies since the marketing budget is quite limited in many companies. Furthermore, SMEs often have knowledge deficites in the field of marketing and management. For this reason this type of company oftentimes has marketing problems what can negatively influence the success of new food products (Menrad 2003a).

Another success factor is a good consumer communication. That is especially important for the food industry as the added value of new products in the food sector often has to be communicated to consumers (Schmalen 2004). This relates in particular to new food products with a high degree of innovativeness and for a market entrance strategy as pioneer. In this context, consumer analyses, a continous information exchange with consumers and the analysis of complaints of consumers and costumers impact the rate of success of new food products conspicously (Menrad 2001).

For promoting consumer goods multiple media can be used. However, the marketing of industrial goods should rather be carried out directly. Especially for the food industry a high intensity of promotion is very important in particular when launching new products as food products are often quite similar (Schmalen 2004). In such cases new products have to be promoted via advertisement spots in print or electronic media, direct mailing activities, sales promotion activities or public relations work like press articles in order to get a better position for listing of these products in the retail shelves.

Role of food retailers

Due to its bottleneck-function (via listing or non-listing of new food products) food retailers are of specific relevance for the success of innovations in this industry. Therefore the adoption behaviour of the food retailers is a factor which impacts the success of innovations of the food industry. The adoption of food retailers increases if a demand of consumers is expected, expansive market sectors are involved and attractive margins are announced for the new products (Pfeiffer 1981). Furthermore, personal contacts to the key deciders of the food retailers and a conclusive marketing concept, in particular specific sales promotion activities during market introduction of new products, are quite important (Feige 1997; Hopkins and Baileys 1971). In addition, the food retailers` behaviour is affected by the visible image of the producer of the new food products (Franke 1998).

Due to the low grade of publicity of their labels many food industry SMEs have only low bargaining power opposite the rather concentrated food retailing companies. The attendance of the food retailers for including a new product in their sales program is a critical success factor for SMEs. The companies just have an influence on this attendance via the quality of the new products (Menrad 2003 a) but they often lack know-how and financial resources to realize extensive sales promotion activities and programmes when launching new food products.

Enterprise size and form of organization

There is no concordant opinion in scientific literature about the impact of the enterprise size on the innovation success of a company. Skilled employment and a high capitalisation are seen as advantages of large enterprises compared to SMEs (Blessin 1998). Studies of Nyström/Evardson (1982) show that large enterprises are more successful than SMEs regarding the product development. However, a number of other authors argues that company size only plays a marginal role and is not very crucial for the innovation success (Rothwell et al. 1974).

According to Stockmeyer who analysed the food and drink industry in Germany, the number of innovation projects is higher in large enterprises than in SMEs. Evidently, large companies have more possibilities for providing resources for innovation activities than SMEs. However, Stockmeyer (2001) also observed that the proportion of successful products is decreasing when the size of a company increases. Probably, advantages in finance of large enterprises are compensated with disadvantages related to large companies, e.g. longer ways of decision-making, loss of flexibility. According to this study innovation processes go on more efficiently in SMEs than in large enterprises (Stockmeyer 2001). Another factor relates to the volume of the target market: Compared to SMEs which are able to deal with niche markets large enterprises need large market volumes to be successful long-term. Such markets are limited and require specific efforts if companies want to create them successfully.

According to scientific literature there seems to be an impact of the form of organization on innovation success in the food industry. Stockmeyer (2001) observed for the German food industry that innovation activity and innovation success is higher in family owned companies and business partnerships compared to cooperatives (Stockmeyer 2001).

Innovation management

Attitude of the management towards innovations

An important basic condition influencing the success of innovations is a management style which is in favour of innovation activities. The scientific literature agrees that a co-operative management style is

adjuvant for the creativity and own initiatives of employees. Typical for a co-operative management style is the involvement of employees in decision-making processes and a wide autonomy of employees how to realize specific projects (Hauschildt 1997).

The attidude and the behaviour of the employees are closly linked to innovation success. This includes active looking for new ideas and fast acceptance of innovations in the project management. Furthermore, it is important that employees do not regard innovations as being to risky in particular at the beginning of such activities (Beham et al. 2006).

Internal organisation within the company

For a successful realisation innovation processes need a concerted planning, steering and controlling as well as an adequate environment within the company. The innovation management has to create an adequate conceptual framework for innovation processes. Furthermore, it is important to create an exchange of information between the acteurs involved in the process of innovation and to clearly determine innovation aims and strategies (Stockmeyer 2001).

Important fields of the innovation management are the generation of ideas, the evaluation and screening of ideas, concepts and products, product design and the planning, steering and controlling of innovation processes (Stockmeyer 2001). For the German food industry, Stockmeyer (2001) asserts the generation of ideas having a significant positive impact on the innovation success of a company. The generation of ideas is the basis for all subsequent steps: Thus the more comprehensive ideas for new products are developed, it is more likely that adequate ideas are generated. In contrast to the process of idea generation, the impact of evaluating product ideas plays a minor role. Indeed, this step is important for enhancing the efficiency of the innovation process but not sufficient for an economic innovation success (Stockmeyer 2001).

After completing the development of a prospective product, it has to be tested if the selected target group accepts the new products. According to Stockmeyer (2001) product tests which are carried out in specific test studios have a significant positive impact on the innovation success rate of a company. Since the food industry sells its products mainly via food retailers to end-consumers, the needs of such end-consumers can be checked in such product tests before the new product has to be introduced in the market (Stockmeyer 2001).

Planning is a very important criterion for the success of a new product. For this reason it should be paid particular attention to the quality of planning of such activities. It is advisable to involve all phases of the development process into the project planning (Maidique and Zirger 1990). In particular SMEs lack experience in planning such activities. The steering of a project contains the appropriation of tasks, the instruction of employees and the solving of conflict situations (Stockmeyer 2001).

Via “project controlling” the original planning of the activities has to be compared and controlled with the project results regarding costs, tasks and current achievements (Hauschildt 1997). Process steering and controlling don´t impact the innovation success significantly. Similar to the evaluation of ideas and concepts, this field is necessary but not sufficient for the economic innovation success (Stockmeyer 2001).

As innovation processes differ from other processes going on in the companies, they need a specific scheme and framework which are adapted on the special criterias and needs of innovation activities. One basic requirement is the formulation of clear and measurable innovation aims and strategies (Stockmeyer 2001). So the aims of innovations should ascertained unmistakably and operational (Hauschildt 1997). Likewise the innovation strategies should formulated clearly (Stockmeyer 2001). One other basic requirement is the application of a target-oriented and flexible organisation and communication structure (Diller 1994). Organisation structures of routine processes within a company cannot be transfered to innovation processes. For creative processes in the early phases of innovation processes, there is need for freedom and flexibility within the organisation since strong restrictions dwarf creativity in this phase. In addition, it is necessary to accept a certain degrees of errors and mistakes since solutions are often not clear and its impacts cannot fully be overseen in early phases of innovation processes (Stockmeyer 2001). However in the following phases of the innovation process aspects of clear decision-making, process steering and controlling gain importance: These points need strong arrangements and defined competences (Stockmeyer 2001). A solution for this “organisational dilemma” is the application of the so called loose-tight-hypothesis. The application of this hypothesis means an alternation of the grade of organisation when progressing in the innovation process. While in the phase of generation of ideas a low grade of centralisation of decision-making is sensible,

standardised rules and central decisions are appropriate in the subsequent phases of innovation projects (Stockmeyer 2001).
Communication structures which enable vertical and horizontal exchange of information within the company and provide comprehensive interfaces to institutions outside the company advance innovations (Stockmeyer 2001). An efficient internal communication system is a crucial criterion for innovation success. As several studies show, there are very good internal communication networks in successful companies (Bergen and Pearson 1983). According to studies dealing with success factors of the food industry the formation of cross-section-oriented and competent project teams and the stimulation of co-operation overlapping different departments are also considerable success factors (Menrad 2001).

Co-operation with external partners

Networks are very important for the success of a company. Successful innovators have special competences in the management of cross company interfaces and networks. So own resources and skills are closely involved with those of the partner companies. Confidence plays an important role in companies´networks. Thus reliability is essential, consistency at co-operation and innovations showing in results do not conflict. Regarding the food industry this factor exists only very sporadic at this time.

An intra-industry exchange also effects positively the success of innovation projects. If a company continously exchanges ideas with other companies of the same branche and co-operate intensively with them, there are much higher chances for successful innovations. However, producers of consumer goods show a low attendance for co-operation with other companies. A continous exchange is also possible with companies of other branches and universities or other research institutions. These partners are able to boost the success in realizing and controlling of innovations (Beham et al. 2006). A co-operation gearing to end-consumers, research institutions and market research institutes also impacts the innovation success significantly – as shown for the German food industry (Stockmeyer and Weindlmaier 1999).

Interactions which are placed between different departments (e.g. R&D and marketing) often create problems. Thus for a successful “Hand off” from the phase of development and the introduction to the market, innovations activities should be accomplished jointly between the involved departments (Schmalen 2004). External sources of information which facilitate the use of scientific knowledge also are important for innovation success. This applies in a special way to SMEs as they are not able to get extensive knowledge of their own R&D activties (also see 3.2.1).

Resources for innovations

The providing of sufficient resources is important for the success of innovation projects (Cooper 1993). The activities which are necessary for innovations realisable if adequate financial, material and personnel resources are available (Stockmeyer 2001). In this context one disadvantage relates to the fact that for getting realisable product ideas, companies have to persecute many ideas. Thereby costs for R&D, production and marketing are increasing thus limiting the possibility for realisation of the ideas which are persecuted. So Roggenkamp (2002) concludes that good ideas often fail because of capital squeezes (Roggenkamp 2002).

According to the results of interviews with 500 companies of the Spanish food industry economic factors are the most relevant barriers to innovation. Particular the lack/scarcity of “ appropriate sources of finance” and “too high expenditures for innovations” have been named being main barriers. These cost factors have an impact on the firm´s innovation potential in terms of R&D efforts and skilled personnel which add to the innovation process “excessive perceived risks” regardless of the perspective increase to profitability to innovating firms. It is worth noting that structural factors (small size of the company) or corporate level obstacles (i.e. “resistance to changes within the company”) scored far less (Martinez and Briz 2000). Similar results show a research project which analysed 500 top companies of the Spanisch industry. Small R&D budgets have been identified as the main economic factor which dwarf the innovation activity. Main barriers regarding the potential of innovations are „uncertainty over the length of the innovation process“ and „costumers not reacting to new products and processes” (Martinez and Briz 2000).

Future developments in science and technology

In the future the food industry approaches a high number of new scientific developments and technical possibilities. Examples for these new technologies are Sous-vide method, Modiefied Atmosphere Packaging and Ultra High Temperature (UHT) Sterilisation (Menrad 2001). Thereby it is adjuvant that

enterprises of the food industry comply with the needed requirements for integrating complex techniques in existing processes and develop new products using these techniques. This does not apply to most of SMEs. For this reason interface competencies have to be established for applying successful innovations. A minimum level of own R&D activities and personnel and financial capacities are necessary for successful innovation activities: Thus future chances can only be realised if the R&D expenditures are expanded in German food SMEs (Menrad 2003 a).

Product characteristics

The attributes and characteristics of new food products determine the success of innovation to a high extent. This is demonstrated in many cases and studies. In this context several aspects are mentioned in scientific literature which are described in the following.

Product advantage

An important aspect for the success of innovations is the product advantage which is realised by the consumers or food retailers (Maidique and Zirger 1990). It is important that product advantages have to be visible for the consumers and communicated by the producers (Cooper and Kleinschmidt 1993). Product advantages can be realised in many different ways. So a better solution of problems, a better service or a better compliance of consumer demands can be seen as a product advantage (Maidique and Zirger 1990). Other authors also consider that products which offer advantages to the consumers, are more successful than others. Successful products solve the consumers´ problems and needs and/or offer higher quality (Kleinschmidt et al. 1996). The study of Schmalen (2004) also identifies “problem solving” as an important success factor as innovative ideas and products are useless if they so not comply with consumers’ needs (Schmalen 2004).

Degree of novelty

The product attribute “degree of novelty” is controversially discussed in scientific literature with respect to its impact on innovation success. Generally it is acknowledged that simple metoo products often do not have specific advantages for consumers or food retailers so that it might be difficult to achieve long-term economic success with such products despite they are offered to a lower price. Some scientists use the contrary argument that a low degree of innovativeness facilitates the success of new products: Kotzbauer (1992) argues that complex and very innovative new products need a lot of explanation and information for consumers which might delay their decision to buy such products (Kotzbauer 1992). Thus the new products which are developed by a company should be placed regarding their degree of innovativeness close to the already existing assortment of products (Cooper 1983). The degree of novelty is also a matter of communication: Product advantages have to be visible to the consumers and communicated by the producers (Cooper and Kleinschmidt 1993).

Product defects

According to a high number of studies the reasons for failure are often linked to product defects (Hopkins and Bailey 1971). The necessity for making additional modifications in the new product during the introduction phase is regarded as being problematic: Additionally to the financial consequences (i.e. higher expenditures for the product development) (Boutellier et al. 1997) there might be also negative side effects on the trust and image of the company and its products. Defects in product characteristics (e.g. lack of durability) which are detected firstly after launching a new product are seen as the most crucial reasons for failure of such products (Cochran and Thompson 1964).

Product concept

According to the study of Schmalen (2004) an emotional product concept matters in the food industry. The new products should be marketed embedded in a certain subjective environment in which the product is in harmony with the needs and behaviour of the target group, the image of the company and the selected distribution channel, the positioning of the product in its competitive environment as well as the presentation of the product. The concept should be held unmodified over a longer time period as processes of acceptance and adoption of new products take some time (Schmalen 2004).

Synergy effects

The using of synergy effects is important for the success of a company. Synergy effects mean the accessing of resources which are already available in the company (Cooper 1979; De Brentani 1989). For this reason a new product should be adapted in the consisting product line (Schmalen 2004). Furthermore, successful products oftentimes have a high acordance between project demand and available resources in the field of R&D and other product development activities (Roggenkamp 2002).

5. Co-operation of SMEs with external partners

The food industry is particularly focused on market possibilities and the needs of end-users. However, at least part of the companies still show shortcomings in this respect. Furthermore, new scientific approaches and techniques are gaining increasing relevance for new product development in the food industry. Empirical research has further stressed the important contribution of supplying industries for innovation activities of food industry companies. The food industry benefits from technical developments in core technology fields (like e. g. biotechnology, microelectronics, computer technology) through a well-developed network of interindustry purchases and sales of equipment and materials (Christensen et al. 1996; Martinez and Briz 2000). A lot of companies of the food industry acquire knowledge by purchasing new equipment or machinery (Christensen et al. 1996; Martinez and Briz 2000), and using new food ingredients developed by the supplying industries (Galizzi and Venturini 1996). Therefore the co-operations between food industry companies and external partners, like supplying industries, end-users (both food retail companies and individual consumers) and research institutions loom large for successful innovation activities (Menrad 2004 a). In this context both formal and informal co-operations and interactions between companies and relations betweeen companies and other acteurs play a decisive role (Menrad 2003 b).

There are different forms of co-operations during the innovation processes of companies. They can be differentiated according to different criteria (Pleschak and Sabisch 1996).

- Content of the co-operation activities
    - Preparation of innovation projects (e. g. market analyses)
    - Basic research activities
    - Applied research activities
    - Constructive and technological development of products
    - Testing of new products
    - Market development
    - Merchandising

- Placing of the co-operation partners in the value chain
    - Horizontal co-operations: companies of the same industrial branche co-operate on their sales market, e.g. for saving costs and time or for using know-how advantages
    - Vertical co-operations: companies of the same branche being placed on different steps of the value chain (e.g. supplier of food ingredients and food processing companies) co-operate with each other.
    - Diagonal co-operations: companies of different branches being placed on different steps of the value chain co- operate with each other (Pleschak and Sabisch 1996).
    - Conglomerate co-operations: companies co-operate on a market having no relation to the ancestral markets of the co-operation partners (Pleschak and Sabisch 1996).

- Intensity of liability in the co-operation process
    - Co-operation for the exchange of experiences: this form of co-operation has the lowest intensity of liability, as an exchange of experiences is possible in all hierarchy levels of a company. Often no organisational arrangements are necessary for this type of co-operation.
    - Co-operation of R&D departments: this type of co-operation is much more intensive and sensitive. For these resaons deeper and more formalized division of labour and higher requirements on the co-ordination and integration of activities are necessary. Thereby the competences of the partners should be similar and complementary (Pleschak and Sabisch 1996).

- Time horizon of the co-operation
    - Short-termed and temporary co-operations
    - Long-termed, unlimited co-operations
    - Strategic alliances: these are co-operations between independent companies or competitors autonomous having the common aim to develop strategical potential for success via the connection of different strengths (Pleschak and Sabisch 1996).

In the following the situation regarding the co-operation with external partners of SMEs in the food industry is drafted. Before doing this, advantages of co-operations as well as reasons for cooperating are presented.

Intern R&D departments of the companies are essential sources for innovation activities. However, the number of R&D employees in companies of the food industry has been reduced in recent years. In Germany, up to one third of SMEs have neither R&D employees nor the spacial and technical requirements which are necessary for R&D activities (Menrad 2003 b). Thus co-operations are used to acquire external know-how not least that the companies can concentrate on their core competencies (Rammer et al. 2006). Thus one motive for contracting out R&D could be missing or not sufficient R&D capacities (Weindlmaier 2001).

Other reasons for co-operations are technological advantages, lower costs of activities for the partners or the aim to accelerate the time-to-market (Weindlmaier 2001). In the scope of co-operations it is also possible to reduce the risk for innovation projects by distributing the risk to several partners (Rammer et al. 2006). Other motives which might lead to co-operations are the use of external impulses and innovation ideas, integrating the needs and wishes of consumers as well as identifying trends in markets and their integration in own innovation projects. Thus it is possible to aim competitive advantages towards other innovators (Rammer et al. 2006).

Especially, vertical co-operations offer possibilities for innovation in SMEs as they are highly adaptive and flexible. Vertical co-operations may also be an impact of increasing the degree of market orientation of SMEs. While it is not clear that there is actually a difference as far as the degree of market orientation is concerned, there are different methods of collecting information. SMEs usually have not the expertise and capacities for extensive market research, they may use different less systematic techniques of market information. A study of SMEs in Denmark has shown that they rely on direct interaction with their immediate costumers to a very large degree for obtaining market intelligence (Harmsen 1994). Vertical co-operation also can mediate the R&D aspect of innovation. Supply with know-how looms large for SMEs. A lack of information is a major obstacle for SMEs. Apart from technical information like technical standards etc. they have a lack of information on legal regulations and on possibilities of financing their projects. Even though there is an increasing supply of public consulting and transfer institutions, SMEs hesitate using these possibilities. They rather rely on personal contacts, information from their customers, from competitors and other producers (Staudt et al. 1992).

According to Beham et al. (2006) successful innovators have special competences in the management of cross-company networks. Generally the food industry is quite hesitant regarding the utilisation of co-operation partners. Stockmeyer (2001) also supports the finding that co-operation with external partners is generally used below-average by the food industry. Mainly horizontal co-operations just play a minor role in the food industry (Schmalen 2004).
Empirical results of analyses of co-operations of food companies in the EU show that domestic partners are preferred as partners in innovation projects. In this context Germany had the smallest share of firms collaborating with foreign partners in a study analysing the innovation activities of the food industry in the EU. In this study, 29 % of the German food companies which had been surveyed have co-operations with other companies in Germany, 10 % with foreign companies, 44 % with public institutions in Germany and 5 % with foreign public institutions (Christensen et al. 1996). The food companies of other countries surveyed mainly also prefer domestic partners for their innovation activities (see table 9).

Table 9: Share of co-operations according to type of partner

Country	Domestic, private	Foreign, private	Domestic, public	Foreign, public	Other partners
Belgium	30	28	34	11	0
Denmark	45	40	26	12	3
Germany	29	10	44	5	0
Ireland	26	33	25	17	2
Netherlands	41	13	24	4	5
Norway	28	26	23	4	5

Source: Christensen et al. 1996

The co-operation activities of 116 food SMEs in Germany have been investigated in a survey in the years 1995 to 1997. As shown in table 10, around 46 % of these companies co-operated with

customers or the supplying industries. Formal contacts were less frequently used while informal contacts were the most frequent form of co-operations. Interestingly, the companies which had been surveyed gave higher relevance to the inclusion of supplying industry companies (74 %) in innovation projects than to customers (48 %). The involvement of both types of institutions in pilot-use studies was even regarded as less relevant (table 10). Co-operations with customers or suppliers were more frequently used than those with other companies (e. g. of the food industry) and research institutions.
Around 26 % of the food SMEs had co-operations with other companies (table 10) mainly by informal contacts and 28 % of the surveyed food SMEs co-operated with research institutions. In this context joint R&D projects (often in form of a PhD or diploma thesis) and the use of laboratories or scientific equipment have been regarded as the most important form of co-operation while research contracts given to scientific institutions were assessed critically (table 10).

Table 10: Co-operations of food SMEs in Germany 1995 to 1997

Institution	Customer	Supplying industries	Other companies	Research institutions
Relevance of co-operations[1)]	46.6 %	45.7 %	25.9 %	28.4 %
Form of co-operation[2)]				
Informal contacts	88.9 %	88.7 %	90.0 %	n. a.
Exchange of experiences	53.7 %	47.2 %	66.7 %	n. a.
Inclusion in innovation projects	48.1 %	73.6 %	n. a.	n. a.
Pilot use studies	37.0 %	41.5 %	n. a.	n. a.
Use of laboratories/equipment	n. a.	n. a.	40.0 %	63.6 %
Joint R&D projects	n. a.	n. a.	26.6 %	60.6 %
Contract research	n. a.	n. a.	n. a.	36.4 %
Joint PhD/diploma theses	n. a.	n. a.	n. a.	60.6 %

The proportion of all surveyed companies have co-operations with the different types of institutions.
The percentage of those companies with co-operations with the relevant type of institution assessed the different forms of co-operations as "very relevant" or "relevant".
n. a.: The respective form of co-operation was not asked for this institution in the survey.

Source: Menrad 2004 a

The estimations which have been found in the ERIS survey are supported by the results of a survey among 265 food companies in 1998 in Germany. This study concluded that co-operations with external institutions in product development projects take place "to a very low extent" (Stockmeyer and Weindlmaier 1999). Mainly suppliers (of machinery and ingredients) and at a low level also retail companies or market research institutes were incorporated in innovation activities. Universities, other companies, consultants or consumers etc. were hardly included, although in particular the inclusion of customers (e. g. retail companies, restaurants, consumers), research institutions and market research institutes had significant positive correlations with the success of innovations (Stockmeyer and Weindlmaier 1999).

The results of both surveys clearly indicate that at least part of the food companies in Germany have substantial shortcomings in the interaction in particular with end-users and customers in innovation projects, although the companies stress the high relevance of market issues and consumer needs in particular for product innovations. The same relates to the co-operation with market research institutes. Only 26 % of the food SMEs which have been surveyed in the ERIS project regularly co-operated with such institutes although market analyses were regarded as most important success factor for product innovations. Furthermore, only a small part of the innovating food SMEs co-operated with research institutions. Often companies fear that details of the innovation project are published or research results are transferred to competitors or other institutions.

Besides surveying of actors of an innovation system another possibility to analyse the co-operations between different institutions is a look at the outcome of these activities. This relates in particular to scientifically-oriented research projects which often result in joint publications. Therefore the partnership between industry and other institutions in selected fields of food and nutrition-related research in Germany have been analysed for the years 1990 to 1992 and 1999 to 2001 using a

bibliometric approach[5]. For this purpose the scientific publications in which the industry in Germany had been involved, have been recherched in the Science Citation Index (SCI) database. If the publications of all fields of sciences are considered in the SCI database, in 5.4 % of all publications in Germany industry companies are involved. Compared to this overall average, the selected fields cereals/sugar/starch, meat/fish health/nutrition and food structure showed an overproportional participation of industry companies (Menrad 2004 a).

However, in comparison to food and nutrition research in total in which around 12 % of all Germany SCI publications came from food industry companies, only the field of cereals/starch/sugar showed an overproportional participation of industry companies. Similar to the results of the companies´ surveys the SCI analysis showed that the partnerships in three of the selected fields were dominated by co-operations among industry companies. Only in the field of nutrition and health (in which often so-called Functional foods are developed) intensive co-operations between industry companies and domestic or foreign research institutions were observed (Menrad 2004 a). Among the research institutions located in Germany in particular university institutes co-operate with industry companies while other types of public research institutes have a minor importance. Furthermore there is a tendency toward internationalisation of the co-operation activities in the selected fields. This mainly applied for the fields meat/fish and health/nutrition. In the last-mentioned field 37 % of the authors of scientific publications in which German industry companies are involved, derive from abroad while only 23 % of involved institutes are from Germany (Menrad 2004 a).

6. Cost and profit effects of innovations

Despite an intensive search in the relevant data bases only few sources regarding cost and profit effects of innovations on SMEs of the food industry could be found in current scientific literature. This relates in particular to the costs of innovations which are rarely empirically analyzed in the past. This might be due to the fact that cost figures are regarded as being sensible from the side of the companies and thus they are not keen to provide such information in particular if they fear that competitors might get access to this information. For the German food industry there are estimations that in general the total costs from the product idea to market introduction of new products are mostly below 1 million € (Weindlmaier 2000). However, for knowledge-intensive products such as Functional Food the development and marketing costs may exceed this level by far. According to expert estimations the costs for product development and launching of Nestlé's LC1 yoghurt in the mid 1990s on the European market as well as the development and marketing of the Becel/Flora proactiv margarine of Unilever exceeded 50 million € each (Menrad 2003 c). In particular SMEs of the food industry are not able to finance such investments not least due to the high risk involved in such activities.

In most cases, different empirical studies show positive associations between innovation and profitability (Geroski 1994 and Philipps 1997). However there are some divergences in research outcomes since the association of innovation and profitability is complex and difficult to measure (Rosenberg 1982). The extent to which innovations can increase profits depends on some different factors. Innovations have both direct and indirect effects on corporate profitability (Geroski et al. 1993). Direct effects include the influence on profit via e. g. a rising market share, indirect effects include improving competitive advantages of a company (Geroski et al. 1993), e.g. by building of core competencies, ability to imitate new products or use new equipment. Innovation may also have an impact on financial aspects (e. g. due to high investments in market introduction of new products which have a negative effect on financial figures short-term) which can affect performance of companies. New products which are launched by successful innovators may inspire trust and give a positive image on the part of investors or financial institutions (Chaney et al. 1991).

When the ratio of R&D to sales is small, as in food and beverages, effects of innovations on profit are probably even more diffuse. Evidence suggests that especially direct effects of innovations on profit, are likely to be small. In 111 firms related to seven US industries, a positive correlation has been found between the number of patents per unit and the profit of the company (Branch 1974). Geroski et al. (1993) also found a positive association between commercially available innovations and profit margins in a sample of large UK firms. However, increases in profitability were modest in most industries and even negative in food and beverages.

[5] The analysis was performed on the basis of the SCI database of STN. In a first step the industrial actors located in Germany were selected out of a list of all institutions which participated in the scientific publications of the selected areas. Afterwards all institutions located in Germany and abroad were selected which have been involved in publications with participation of industrial companies.

As most foodstuffs are easy to imitate (OECD 1988) the period for the innovator is short in which he can obtain monopolistic gains. So only small direct effects are to expect for the food and beverages industry. However, in some cases innovations can have indirect effects on variables affecting the rate of profit (Narin et al. 1987).

Another area in which authors in scientific literature have differing opinions is the question how and to what extent the profitability of a company influences future innovation activities. Disagree is over "reverse causation", i.e. profit rates which affects subsequent R&D. Most studies have founded that profit rates impacts subsequent R&D only slightly, but Graboswki (1968) who investigated R&D expenditures relative to sales in 41 large US firms, provides an exception to this general view (Grabowski 1968). Other authors argue that the R&D profitability and liquidity may determine innovation in SMEs, as the R&D budget of SMEs is more subject to economic fluctuations compared to large companies (Kay 1979) which usually have enough internal funding to finance innovations (Acs and Isberg 1991). Kamien and Schwartz (1975) concluded that "the empirical evidence that either liquidity or profitability are conducive to innovative effort appears slim".

7. Summary

This review has systematically surveyed relevant literature on the structure of the food industry, innovations in the field of food as well as economic impacts of innovations on companies of the food industry. In this context there was a specific focus on small and medium sized enterprises (SMEs) and traditional food products (TFPs).

With a total production value of 836 billion € in 2005, the food industry ranks first in the total manufacturing sector of the EU. France, Germany, Italy and Spain are the most important countries for producing foods and drinks (accounting for about 70 % of the total turnover). Up to 99 % of the food and drink companies in the EU are SMEs. The most important categories within the food and beverages industry are meat processing, beverages, dairy products and various food products.

As there is no generally agreed definition in the scientific literature so far, it´s quite difficult to define the term "traditional food products". However, the availability of food products of at least 50 years on the EU markets could be identified as a key criterium for defining TFPs.

Generally, the food industry is regarded as a sector with low R&D intensity. Despite the low R&D intensity of the food industry in the EU, relatively high differences among the companies are notable. Large food multinationals oftentimes spend more that 1% of their turnover on R&D activities. On the other hand, at least 20 % of the companies do not carry out R&D activities at all.

In 2003 dairy products are the leader in the number of innovations (i.e. measured in the number of new products on the market) in the EU, followed by cheese and ready made meals. A relatively high number of innovations do not survive in the market over a longer time period. During 2000 and 2001, around 50 to 67 % of the new food products in Germany have been withdrawn within one year from the food retailing shelves.

In view of the high failure rate of innovations it is very important for the food industry to ascertain factors that yield to innovation success. There are many factors which impact the success of innovations. In the field of market research and marketing it is very important to carry out consumer analyses for getting knowledge of requirements, price sensitivity and buying behaviour of consumers. Furthermore the innovation management impacts the innovation success. So a concerted planning, steering and controlling of innovation processes is important. Companies should offer an innovation-friendly culture and administration, because the attitude and the behaviour of the employees are closely influencing the success of such activities. An efficient communication is also necessary for the success of innovations. Very good and intensive internal and external communication networks and co-operations are ascertained in successful companies.

Generally the food industry is quite hesitant regarding the utilisation of co-operation partners.
A preference for domestic partners is characteristic for the co-operation behaviour of SMEs in the food industry. Furthermore many studies show that co-operations with customers and suppliers are more frequently used than those with other companies. In most cases, the contacts of the food industry with external partners are informal.

There are only few sources in scientific literature regarding cost and profit effects on innovations of food SMEs. In most cases several empirical studies show positive associations between innovation and profitability. However in the food and beverage industry only small direct effects are to expect.

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