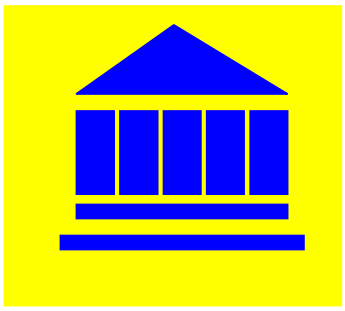

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CHOCOLATE INDUSTRY IN A NEW EUROPEAN PERSPECTIVE

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TABLE OF CONTENTS

1. OBJECTIVES OF THE STUDY

New Europe means that East European countries are „preparing themselves for operating under the requirements of the European Union's internal market" (White Paper, 1995). Within the perspective of new Europe the chocolate industry in Belgium, Great Britain and Poland is analysed and compared. The chocolate industry is an excellent case to find out the different background and competitive structure of food industry in Europe. The aim of the study is to focus on the chocolate industry in a new European perspective. The analysis of that industry in Belgium, Great Britain and Poland comprises different components. The main topics are the megatrends, the legal requirements, market leaders, quality control and sensory analysis at consumer level.

Chapter two is dealing with the megatrends in chocolate industry. Getting started with the history of chocolate the production and consumption during the last years are analysed. Also some new major trends are developed.

In chapter three the Belgian, English and Polish foodlaw are compared with the emphasis on harmonisation within the European Union as well as the process of preparation of the Central and East European Countries (CEEC's) to join the Single Market. The national legislation are studied in depth with special attention paid on the methods of chocolate evaluation. Additionally, standards of International Organisation ISO and standards of Codex Alimentarius are considered briefly. At the end of the chapter a comparative synthesis is made between the legal requirements in the three countries.

In chapter four the leading Belgian, English and Polish chocolate manufacturers are discussed. The competitive structure, future market shares and strategies are concluded from the data available. Other important manufacturers are mentioned as they are also competitors in the chocolate sector.

Quality Control and Quality Assurance concepts are analysed in chapter five. The major part is about the Quality Control in chocolate industry. Also a comparison is made about quality control practices in a Belgian and Polish company. Hazard Analysis of Critical Control Points system, Good Manufacturing Practices and in-line

methods of quality control in chocolate manufacture are also shortly described. Finally, recent EU-regulations are developed.

Chapter six focuses on the empirical research about the taste of chocolate from Belgium, England and Poland. This consists of the sensory analysis, which was carried out on a real international panel while aiming into the estimation of the consumer preferences and comparing different attributes of three kinds of chocolates from the three countries.

The chosen methodology consisted of two basis tests i.e. Attribute Test and Hedonic Scale Test. Brands of chocolates used in the experiment included the two leading companies from Belgium (Callebaut and Côte d'Or), two from the UK (Cadbury and Terry's) and two from Poland (Wedel and Wawel).

In the last chapter the general view on the chocolate industry, in the time of the removal of all technical barriers within the expanding European Union market is discussed. The White Paper says that these works will take some time to be finished as „..in certain product areas, especially food...which are potentially hazardous but are in general use...the old approach of full harmonisation is still considered the more appropriate".

It should be noticed that „...this legislation...establishes rigorous testing and certification requirements..." like those of „...the denomination of certain products, their labelling and/or their packaging..." and the problems may arise. It is well known that „A Member State forming part of the internal market must not only be able to create the conditions for the production of goods which correspond to Community standards, but must also be able to guarantee that all goods on its market meet those standards".

It is strongly believed that progress in the harmonisation of the European foodlaw has a positive impact on the increased competition, from which all the nations may take the advantage.

2. MEGA TRENDS: YESTERDAY, TODAY & TOMORROW

2.1 HISTORY OF CHOCOLATE

The cocoa beans for commercial use are the seeds of the tree from species Theobroma cacao L. In fact, the genus Theobroma consists of some twenty species of small bushes and trees from Sterculiaceae family, but Theobroma cacao is the only one of commercial value.

„Cacao" is the botanical name that refers to the tree, the pods and to the unfermented beans, while „cocoa" refers to the manufactured product - that is the powder which is sold for drinking purposes or food manufacturing. However, recently the last name i.e. cocoa has been used to describe the fermented cocoa beans in bulk.

The cocoa tree (Theobroma cacao) comes from the tropical Amazon forest where the semi-shade and high humidity make excellent conditions for its growth. It was cultivated by the Mayas of the Yucatan and also by the Aztecs of Mexico for at least 1000 years before it was seen in Europe. Mythology of Indians said that the seed of this tree had been carried from the New World version of the Garden of Eden in Mexico by Quetzalcoatl, God of Air. The fruit of cocoa tree was favourite of the Gods (Schoen, 1951, a).

According to the legend, Montezuma - Emperor of the Aztecs regularly consumed a preparation called „chocolatl" that was made from the roasted and grinded cocoa nibs which were then mashed with water, maize and spice flavours. This drink was devoted the Goodness of fertility Xochiquetzal.

The Aztecs believed that cocoa tree was of the devine origin and because of that, the Swedish botanist, Linnaeus, later christened the fruit of cacao species as „Theobroma cacao". Theobroma in Greek means - „Food of the Gods".

A chocolate drink was invented by the Aztecs and as it was believed to have aphrodisiac properties they used to consume it at wedding ceremonies. The seeds were considered to be very valuable and were also used as mean of barter in Aztecs - Mayan civilisation. That time a good slave could be purchased for 100 beans.

It is worth to note that cocoa beans were introduced to Europe long before coffee and tea. Columbus brought them as curiosities, but his countryman Don Cortes recognised their commercial value. He also sent the first recipes for the preparation of a new chocolate drink to Spain. Spaniards found the value of cocoa beans and kept a monopoly on its use and production for almost a century. They sweetened the chocolate drink accordingly to their preferences and soon after this drink gained high popularity.

The cocoa beans were also introduced into Africa, Indonesia and Ceylon by the Dutchman. The popularity of the chocolate drink spread to the continent, especially to Italy, Holland and France in 1600s. That time the price of „chocolate" was extremely high so it was a product for wealthy people.

In the beginning of the eighteenth century prices of cocoa became lower and the commercial manufacture started in Bristol, where in 1728 the firm of J.S. Fry established the first chocolate factory in England. Chocolate was produced here for drinking purposes. As the original chocolate, prepared from the roasted whole beans or „nibs" and sugar, was an extremely rich drink (because of high fat content) some manufacturers reduced it by the addition of farinaceous (starchy) substances.

However, in 1828 Van Houten of Holland introduced the press machine that expressed some of cocoa butter (Minifie, 1980). This way the quality of chocolate improved. It will be probably surprising for many of the readers that the eating chocolate was invented only 120 years ago. In 1876 Daniel Peters of Vavey in Geneva developed first milk solid chocolate, the product consumed until today in the highest quantities comparing to dark or bitter chocolate. Two years later in 1879 Rodolphe Lindt, as a first, implemented the conching machine into the chocolate mass production (Hundert Jahre Schokoladenconche, 1979). Later on, the invention of „milk crumb" process introduced the popular caramelised milk flavour so much desired by many of us. Initially, only plain (dark) chocolate was used to coat nuts and other fruits but British firms, particularly Cadbury, pioneered in first boxes of milk chocolates and the chocolate bars for a wider market. About 1910 the first popular filled (composition) bar chocolate was created in the USA (Nuttall, 1994).

It is well known that history of chocolate is a part of history of church. In the medieval convents the true chocolate orgies took place as the Pope recognised the

chocolate drink as the fast meal. After 1502 monks started the culinary experiments with „brown beans" but these are nuns who are responsible for development of „cacao" drink made from the original bitter beverage with addition of honey, corn flour and vanilla.

In 1569 the Pope Pius V was forced to take the official standpoint on the usage of chocolate drink. The enemies of chocolate demanded the prohibition of a „devil drink" that caused excitement reactions. In the twentieth century, scientific research revealed that the caffeine, theobromine and high content of Magnesium lead to aphrodisiac properties of the drink. Pope Pius V did not know these data but he also did not liked sweets. Therefore, after drinking a cup of chocolate he made a wry face and called a drink as „swinish stuff". As a result chocolate drink was ordered for a strong penance. In seventeenth century the another Pope prohibited chocolate drink again. The sweet business was soon noticed by Protestants from Switzerland such as Cailler, Suchard and Nestlé who very soon made a chocolate as a symbol of their country.

2.2 TODAY'S PRODUCTION, EXPORT AND CONSUMPTION

2.2.1 Trends in the European Union-12

The EU-12 trends considered in this part are focused on two aspects. Firstly, the general evolution of production and consumption of the different types of chocolate is analysed. Secondly, the main evolutions in separate countries of the EU are described.

Based on CAOBISCO data, the general production and consumption during the period of 1990-1994 is analysed as follow:

Tab.2.1. Production of chocolate in the EU-12 (1000 tonnes)

PRODUCT DESCRIPTION	1990	1991	1992	1993	1994	% CHANGE 1994/90
Unfilled Chocolate	552	583	562	616	627	13.6
Filled Tablets/Bars	527	529	536	574	601	14.0
Pralines/"Chocolates"	516	544	562	507	527	2.1
White Chocolate	1	2	2	7	7	600.0
Sugar Conf. ctg. cocoa	61	54	55	127	138	126.2
Total of all finished chocolate confectionery	**1,679**	**1,733**	**1,739**	**1,853**	**1,923**	**14.5**
Beverage Mixes ctg.cocoa	109	120	132	151	155	42.2
Spreads ctg. cocoa	159	165	167	171	199	25.1
Other foods ctg. cocoa/choc.	32	42	48	64	65	103.1
Total of all reported chocolate products	**1,979**	**2,061**	**2,085**	**2,241**	**2,343**	**18.4**

So: (CAOBISCO, 1996)

Depending on the product type the evolution in production is quite different. The production of unfilled chocolate and also filled chocolate tablets is permanently increasing at a growth rate of about 3.5% per year. The production of pralines reached a top in 1992 and after a big drop in 1993 regained slightly in 1994. White chocolate production was not increasing till 1992 and made a famous jump forward in 1993 and 1994. The production of sugar confectionery is also more than doubling in 1993 and 1994 related to the production of 1992. Beverage Mixes based cocoa is regularly increasing at about 10% rate per year, with a slight drop in 1994. The production of cocoa spreads is also increasing at 6.2% rate per year. Other cocoa foods production is doubling during the period of 1990-1994. The total chocolate production is increasing about 3.6% per year, which is about twice the economic growth during this four year period.

The EU-12 is largely self-sufficient in the chocolate production. The net exportation of chocolate products increased from 158,000 tonnes in 1990 till about 342,000 tonnes in 1994. Most of the exportation is to high income countries. New prosperous markets are the countries in the Far East with a growing economy and demand for luxury food.

Corresponding with the increase in production the consumption per capita of chocolate is also growing permanently. However, the consumption decreased in 1992 in comparison to 1991 and increased again in 1993 and 1994.

Tab.2.2. Per capita consumption of chocolate in the EU-12 (kg/head)

PRODUCT DESCRIPTION	1990	1991	1992	1993	1994	% CHANGE 1994/90
Unfilled Chocolate	1.53	1.67	1.59	1.67	1.55	1.3
Filled Tablets/ Bars	1.43	1.42	1.39	1.34	1.47	2.8
Pralines/"Chocolates"	1.44	1.52	1.54	1.32	1.30	-0.8
White Chocolate	0.01	0.01	0.01	0.05	0.04	300.0
Sugar Confec.ctg.cocoa	0.12	0.13	0.13	0.33	0.36	200.0
Total of all finished chocolate confectionery	**4.59**	**4.82**	**4.73**	**4.77**	**4.79**	**4.3**
Beverage Mixes ctg.cocoa	0.29	0.31	0.35	0.39	0.40	37.9
Spreads ctg. cocoa	0.44	0.46	0.45	0.47	0.52	18.2
Other foods ctg. cocoa/choc.	0.11	0.14	0.15	0.19	0.18	63.6
Total of all reported chocolate products	**5.29**	**5.55**	**5.49**	**5.65**	**5.74**	**8.5**

So: (CAOBISCO, 1996)

The consumption per head of all reported chocolate products increased about 2.1% per year with a 1.1% increase for finished chocolate confectionery. Behind the general figures of the EU-12, the specific evolution and situation dependent of the countries is presented below.

Tab.2.3. Production of finished chocolate confectionery in the EU-12 (1000 tonnes)

COUNTRIES	1990	1991	1992	1993	1994	% CHANGE 1994/90
Belgium/Lux	110.5	112.7	121.4	124.2	125.6	13.7
Germany	512.8	533.2	504.5	559.1	585.3	14.1
Denmark	19.7	22.1	21.2	20.2	19.1	-3.1
Spain	40.8	42.1	41.6	46.5	53.2	30.4
France	225.4	247.4	253.9	266.4	272.0	20.7
Greece	21.0	21.5	21.5	22.0	22.3	6.2
Italy	106.3	107.8	116.5	137.7	137.3	29.2
Ireland	29.9	27.5	27.9	29.5	39.6	32.4
Netherlands	161.6	166.0	172.0	185.0	181.0	12.0
Portugal	2.5	2.9	2.5	3.0	2.9	16.0
UK	448.3	449.9	454.0	459.7	484.8	8.1
TOTAL: EU	**1,678.8**	**1,733.1**	**1,738.8**	**1,853.4**	**1,923.1**	**14.5**

So: CAOBISCO, 1996

It is interesting that the production of finished chocolate confectionery has increased at a high rate during the period of 1990-1994 in countries with a rather less developed chocolate industry such as Ireland, Spain or Italy. In France and Portugal a significant increase in chocolate production was also reported.

The difference between production and consumption per head gives a general view of the exportation orientation of the country. Here it is becoming clear that about half of Belgian production is exported, while this is about 8% for Germany and the UK production. That is the main factor behind the good image of Belgian chocolate.

Tab. 2.4. Per capita consumption of finished chocolate confectionery by the EU-12 Member States (kg / head)

COUNTRIES	**1990**	**1991**	**1992**	**1993**	**1994**	**% CHANGE 1994/90**
Belgium/Lux	7.4	7.5	7.8	7.1	6.4	-13.5
Germany	6.8	7.1	6.5	6.8	6.7	-1.5
Denmark	5.6	6.6	6.8	6.7	6.6	17.8
Spain	1.4	1.5	1.4	1.5	1.4	0.0
France	4.3	4.7	4.7	4.5	4.6	7.0
Greece	Figures not available			2.5	2.6	-
Italy	1.8	1.9	1.9	2.2	2.3	27.8
Ireland	6.4	6.7	6.6	7.6	7.5	17.2
Netherlands	4.0	4.7	5.2	4.6	4.7	17.5
Portugal	Figures not available			0.6	0.6	-
UK	7.4	7.4	7.4	7.2	7.7	4.0
TOTAL: EU	**4.6**	**4.8**	**4.7**	**4.8**	**4.8**	**4.3**

So: CAOBISCO, 1996

The per capita consumption is quite different from country to country. The North EU Member States have a consumption level of about 6.4 to 7.7 kg/head. The consumption in the Netherlands is about 4.6 kg/head and lower than in the other Northern countries. The South EU i.e. Mediterranean Member States have a consumption of maximum 2.6 kg/head.

Quite remarkable is the decrease in consumption during 1993 and 1994 in Belgium, Luxembourg and Germany and static consumption is observed in Spain. The increase in consumption is seen in Italy, Ireland, the Netherlands and Denmark.

2.2.2 Chocolate production

2.2.2.1 Chocolate production in Belgium

According to the market survey (EIU Marketing in Europe, 1994) production of chocolate confectionery, including industrial products for use in biscuits and cakes, rose steadily to about 300,000 tonnes in 1992. That can be compared to the sugar confectionery and accounts for four times larger production in case of chocolate products production. It was growing by an annual average of almost 12% since 1986.

The Belgian confectionery sector is dominated by chocolate and cocoa-based confectionery. In 1990 these products accounted for 55% and 29% of sales value respectively. Coating chocolate remains the largest segment of the chocolate confectionery industry, accounting for 50% of tonnage output.

Tab.2.5. Production of chocolate confectionery by product type in Belgium (1000 tonnes)

	1990	1991	1992	% CHANGE 1992/91
Chocolate				
Coating chocolate	146	157	167	6.5
Plain chocolate	14	14	14	1.9
Milk chocolate	26	25	26	3.0
Filled bars[a]	21	21	23	8.9
Whole chocolate sweets	0.8	1	1	16.1
Sub-total	**209**	**218**	**231**	**6.1**
Cocoa confectionery				
Chocolate sweets[b]	41	42	47	11.0
Other	17	19	20	3.2
Sub-total	**59**	**61**	**66**	**8.5**
TOTAL	**268**	**279**	**298**	**6.6**

[a] - All sizes. [b] - Chocolate-coated sweets (incl. pralines)
So: EIU Marketing in Europe, 1994

2.2.2.2 Chocolate production in the United Kingdom

Market volume of confectionery industry in the UK has been static since 1990 due to the recession. Chocolate confectionery makes it one of the largest consumer goods markets.

Filled bars account for 36% of sales, bars for 19%, pieces and boxes for 31% and seasonal and other chocolates for 14% (EIU Retail Business, 1993).

Tab.2.6. Production of chocolate confectionery by type in the UK (1000 tonnes)

	1990	**1991**	**% CHANGE 1991/90**
Bars, blocks & tablets			
Unfilled			
plain, blended	3.4	3.4	-
milk, white	63.9	63.3	-1
With inclusions	26.2	23.7	-10
Filled			
biscuits, wafer	80.7	80.3	-1
other centres	150.1	147.7	-2
Total	*324.3*	*318.4*	*-2*
Chocolates/pieces			
Liqueurs	1.1	0.9	-18
Bulk	9.2	11.3	23
Assorted	47.7	44.9	-6
Unassorted boxes	13.0	12.0	1
Other	54.3	59.0	9
Total	*125.2*	*128.1*	*2*
Other			
Eggs	21.0	23.2	10
Bouchées	5.4	4.8	-11
Other	5.1	4.8	-6
Total	*31.5*	*32.7*	*4*
Selection packs	9.7	9.5	-2
TOTAL	***490.6***	***488.6***	***-4***

So: EIU Retail Business, 1993

Figures showing manufacturers' home trade despatches give a more detailed picture of the market. These figures do not include imports but, since imports account only for about 4% of the market, they are the approximate values for the market.

The largest volume sector, Bars, Blocks and Tablets, showed a 2% volume decline in 1991 over 1990. Within this section, filled categories which account for 46% of the total were 1% and 2% down, while the unfilled with inclusions segment was actually 10% down in volume in 1991 versus 1990.

Assorted and unassorted chocolates held up quite well in total with a 2% volume gain in 1991 versus 1990. This sector has a 26% share of the total market and had more disparity in trends among segments. Liquors for example actually dropped

by 18% in 1991 versus 1990. In other sector eggs was one of the stronger sectors with a volume gain of 10%.

In conclusion, it may be said that the trend in filled countlines (46% of the volume) has the overriding influence on the market.

2.2.2.3 Chocolate production in Poland

Tab.2.7 Production of chocolate and chocolated products in Poland (1000 tonnes)

	1990	1991	1992	1993	1994	% CHANGE 1994/93
Chocolated products	46.0	68.1	66.8	82.1	82.1	0.0
Chocolate	20.0	28.7	38.7	45.6	48.9	7.2

So: GUS, 1995

Taking into account Polish production within the chocolate confectionery industry, it may be noticed that a trend toward 'real' chocolate products has significantly increased, and the level of the production of the chocolated products (these are all products covered by chocolate, like filled biscuits, wafers, pralines and all kinds of seasonalities) remains stable.

During transition from command to free market economy, especially between 1992 and 1993, a significant increase in production of chocolate products was noticed. That may be due to the competition that has inevitably risen between the Polish manufacturers and new entrants, such as new 'joint-ventures' companies and also imported brands like Lindt & Sprüngli from Switzerland.

2.2.3 Foreign trade

2.2.3.1 Foreign trade for chocolate in Belgium

According to the Association Royale des Fabricants de Confiserie (ARFC), imports of chocolate confectionery in Belgium grew by 4% in 1992 to 63,915 tonnes. In 1992 chocolate imports were some 50% above their 1986 level but they have tended to show only modest annual growth over recent years.

On the other hand, the National Statistical Institute (INS/NIS) states that the value of exports is three times greater than the value of imports. The difference in volume is much smaller, evidencing the high added value in many of the products

exported from Belgium. In volume they accounted for 55% of Belgian production in 1992.

Because of the fact that sales in Belgium are not likely to show much growth, exports are a major element for the industry and further expansion can be expected in export sales. This success in exporting comes from the international reputation of Belgian luxury chocolates and from the location in Belgium of production facilities of multinational companies that supply North European markets.

Tab.2.8. Foreign trade in chocolate products in Belgium , 1990-92 (1000 tonnes)

	IMPORTS			EXPORTS		
	Cocoa[a]	**Chocolate**	**Total**	**Cocoa[a]**	**Chocolate**	**Total**
1990	28	55	83	2	131	134
1991	31	61	93	1	155	156
1992	38	62	101	1	163	165
% change 1992/91	**22.5**	**1.8**	**8.8**	**1.8**	**5.6**	**5.6**

[a] - includes cocoa butter and powder

So: EIU Marketing in Europe, 1994

2.2.3.2 Foreign trade for chocolate in the United Kingdom

On the contrary, exports in the United Kingdom tended to increase at the beginning of 1990s. Between 1986 and 1991 import penetration increased from 11.8% to 13.1%. It is important to notice that this increase was entirely due to imports from the major UK manufacturers.

With Nestlé and Mars being international players, manufacturing in the UK is not longer necessary therefore many of these brands are situated in different countries in the continental Europe. The volume of imports from foreign manufacturers has fallen, confirming the dominance of the big three i.e. Cadbury, Nestlé Rowntree and Mars.

The major export market is the Republic of Ireland, which does not have its own manufacturers and brands. Other important countries that the UK exports to are Saudi Arabia, Germany, France, Canada and the Netherlands.

Tab.2.9. Foreign trade in the UK by type of chocolate confectionery in 1991 (1000 tonnes)

	IMPORTS	EXPORTS
Unfilled tablets and bars	22.3	10.9
Other unfilled	3.5	1.8
Filled tablets and bars	18.6	20.1
Chocolate liqueurs	1.5	0.3
Other chocolate confectionery	7.5	36.2
Sugar confectionery with cocoa	8.9	16.1
White chocolate	4.3	1.3
TOTAL	**66.5**	**86.7**

So: EIU Retail Business, 1993

2.2.3.3 Foreign trade for chocolate in Poland

In Poland, imports of cocoa products dropped over the 1986-90 period, except for chocolate items. Cocoa bean imports fell from 26,000 tonnes in 1988/89 to an estimated 22,000 tonnes for 1990/91. Imports of cocoa cake and powder also decreased and imports of cocoa butter and cocoa liquor were almost negligible during that period.

Poland has traditionally exported a large quantities of cocoa butter, of about 4,000 tonnes annually over the last several years. However, the cocoa cake and powder produced as a result of the processing of cocoa beans have been mainly used within the country.

It is important to notice that Poland has been the only East European country to import large volumes of finished chocolate products. In 1989/90 these imports accounted for 6,620 tonnes. Poland also exports the finished chocolate products, with foreign sales coming to 1,400 tonnes in 1989/90 (Byskov, 1991).

Tab.2.10. Imports of cocoa and cocoa products, 1988-90 (1000 tonnes)

	COCOA BEANS	COCOA BUTTER	COCOA CAKE & POWDER	COCOA LIQUOR	CHOCOLATE
1987/88	20.2	0.0	2.7	0.0	2.6
1988/89	26.0	0.0	5.3	0.0	3.5
1989/90	24.0	25.0	1.7	20.0	6.6

So: Byskov, 1991

It should be said here that since privatisation of chocolate industry in Poland the data concerning especially foreign trade are not obligatory for delivering by companies to governmental institutions and marketing analyses of consumption patterns are not frequently performed. Therefore, it was impossible to get more current data on trade in total chocolate sector in Poland.

2.2.4 Chocolate consumption

2.2.4.1 Chocolate consumption in Belgium

Consumer research suggests that Belgian consumers perceive „Belgian style chocolate as having a robust, heavy and slightly bitter flavour, while Swiss style chocolate is a slightly more refined product" (EIU Marketing in Europe, 1994). For instance, typical Belgian pralines being more delicate and interesting in taste have a significant advantage over the other chocolate products as they do not need to contain food preservatives. Therefore, they are not eaten but „tasted" according to specialists.

Seasonality is a feature of the Belgian market, with slight falls in sales in the summer months and in the period of January-March. One of the possible reasons for that is the high temperature during the summer period. Fall in sales in the first quarter of the year is supposed to be due to the excessive buying process of chocolate products over the Christmas and New Year time on the one hand and during the Easter time on the other one.

Tab.2.11. Belgian chocolate consumption by product type in 1992 (1000 tonnes)

PRODUCT TYPE	TONS	% OF TOTAL
Candy bars (countlines)	25	30
Pralines	18	20
Chocolate bars (100g & over)	12	15
Chocolate bars (50g)	10	12
Chocolate spread	8	10
Seasonal items	5	6
Chocolate drops	2	3
Other	2	2
Total	**81**	**100**

So: EIU Marketing in Europe, 1994

The above table shows the strong position in the market occupied by candy bars, or countlines, and also the classic Belgian pralines which are just as popular at home market as it is abroad. These two items account for over half of market volume.

2.2.4.2 Chocolate consumption in the United Kingdom

In the United Kingdom, between 1987 and 1990 consumption of chocolate confectionery rose by 3.4% per year on average. Since then consumption has declined slightly.

It was confirmed that women are the main buyers of confectionery (66%), while children account only for 8% of purchases. Males tend to buy for themselves and consume less per head then women and children.

Tab.2.12. Purchasing and eating patterns for confectionery in 1992 (%)

	POPULATION	PURCHASERS	EATERS
Women	41	66	39
Men	39	26	26
Children	20	8	35
Total	**100**	**100**	**100**

So: EIU Retail Business, 1993

The different regional consumption trends in the UK are presented in the next table. These patterns of consumption vary significantly.

Tab.2.13. Index of regional consumption of chocolate confectionery in 1992 (British average=100)

REGION	INDEX
Scotland	128
North East	113
East Anglia	104
South	103
Midlands	101
London	99
Yorkshire	93
Wales	90
Lancashire	89

So: EIU Retail Business, 1993

2.2.4.3 Chocolate consumption in Poland

In Poland per capita consumption of cocoa has usually been at a fairly low level and some manufacturers predict prospects for market growth.

Since January 1992 no substitute for cocoa butter has been allowed and that also had a positive influence on the consumption of cocoa beans in the country but the newest data are not available.

Tab.2.14. Per capita consumption of cocoa and cocoa products in Poland (kg/head)

CROP YEARS	PER CAPITA CONSUMPTION
1987/88	0.49
1988/89	0.74
1989/90	0.61

So: Byskov, 1991

It may be noticed that in bigger cities such as Warsaw people are more willing to buy small chocolate confectionery which is sold by weight and not solid blocks such as bars or batons. Polish countlines are not only more cheap than foreign brands but also perceived as products of high quality and desired taste.

2.3 MARKET PROSPECTS

Predicting the future is always a very risky task however a few possible trends may be indicated. The future market prospects are related to such factors as raw materials, technological trends, legislation changes and consumer satisfaction.

Confectionery may prove to have the advantage in comparison to other foods because of easy transportation, product size in relation to quantity of energy provided and its excellent taste. Taste is highly influenced by raw materials as well as methods of processing. The source and quality of cocoa beans, the basic raw material of all chocolate products, has been changing over the last few decades. Old, traditional regions like West African have decreased in supply and new regions such as

Malaysia have expanded. It is well known that each location of cocoa beans provides its individual, characteristic flavour.

However, not only cocoa beans origin but also the methods of their processing are of great importance for the final flavour of chocolate. At present the process of roasting of the whole beans has been replaced by roasting of nib or sometimes of cocoa mass. Conches have tended to became bigger and there is a movement among the larger manufacturers towards large-volume processing lines.

Thus, there is the increased need for the installation of advanced techniques of computer control and instrumentation and that results in the reduction in the workforce. Development in chocolate industry is foreseen by means of the improved process control through the automatic on-line instrumentation, networks and computer management. These technological trends will probably continue among large manufacturers, while smaller chocolatiers take advantage of confectionery prepared for niche markets i.e. the high-priced chocolate and sugar confectionery that are sold through specialist outlets.

Larger firms will capture important proportion of the national as well as international market and on the other hand, some smaller specialist firms that retail their own goods will also expand in many countries, as Belgian Godiva or Leonidas do in the USA and Japan. Their products are meeting a demand for a special, delicious kind of treat, they may be purchased as everyday snack but also on special occasions like gratification, sharing or as a gift. Another difference between these two types of manufacturers is the composition of their chocolate. It shall be remembered that the ‘real’ chocolate and couverture chocolate are not the same products.

While the legislation will probably stay strict for the former (basically produced by large companies), for the latter is likely to extend in its constituents range and therefore, the change of its quality. The use of cocoa butter equivalents and substitutes as partial or total replacers is not allowed according to the European Union foodlaw and it is rigorously guarded by e.g. Belgian law. However, the amount of 5% of vegetable fats as substitutes of cocoa butter is allowed in the other Member States’ foodlaw.

Additionally, researchers undertook trials with hydrogenated fats in cocoa products. In spite of the fact that the addition of these fats leads to the improvement in texture and bloom resistance of chocolate products, neither in England nor Belgium nor in any East European country they are allowed to be used in confectionery. In continental Europe whey- or lactose-derived substances are incorporated in many chocolates, although a few research works cannot show their success because of the objectionable flavours of such chocolates (Mohler *et al.*, 1981).

Another important factor - at least at the beginning of purchase process - is the appearance of a simple chocolate bar or the sophisticated box of chocolates. It was and it will probably be always important how to attract the potential customer through the special packaging design, correct use of colours and symbolic devices that denote manufacturing houses. Invention of new machines for packaging will contribute to the rapid change of the range and quality of packaging. Because of the „Green" movement there is a trend towards reduction in the amount of packaging used, and preferences for the use of degradable or recyclable materials. One of the possible suggestions in the past was the use of an edible moisture-proof film sprayed on confectionery as to eliminate the necessity of wrapping media. That idea seems to be totally impractical since the packaging should be designed to protect the product from dirt and physical damage and possible knocks. In the above idea these requirements could not be fulfilled. However, the move into the direction of bio-degradable materials will continue as strongly as the trend towards the products with a generalised „healthy" appeal, whether described as „natural", „no artificial" or „low - calorie" (Nuttall, 1980). It should also be mentioned that such „low-calorie" or „sugar-free" products have gained high popularity in many markets as now many diabetics or people on special diets do not need to avoid so much loved chocolate products.

As traditional markets tend to remain fairly static in size, there will be a continuous search for new markets. Eastern Europe, Far East and Arabic countries are only a few to be mentioned. In case of hot countries, the development of heat resistant chocolate, like the Hershey Desert Bar has been of great importance. Probably the biggest challenge that is open to the confectionery industry of East

European countries is to decrease the large gap that exist between consumption levels in advanced and industrialising countries. This process has already started and developing countries show trend of higher consumption of confectionery.

The two recent decades indicate that the confectionery manufacture has really expanded both in product types and into more countries all over the world, through new marketing strategies like acquisition of another firm or diversification.

Generally, it is predicted that if the undertaking of dental caries increase and preventive methods be more widely used the confectionery industry may be very optimistic about the chocolate consumption worldwide. Additionally, the on-going demographical shift towards an ageing population is expected to influence the market in some degree. Therefore, many products should be repositioned effectively to appeal to different customer groups.

Much can be said about the possible success of chocolate industry but it seems to be clear that the success will strongly depend on efficiency of chocolate producers and will also relate to meeting the demands of consumers and retailers not only in their own country but worldwide.

3. LEGISLATION FOR CHOCOLATE

INTRODUCTION

At present time, a trend towards harmonisation of foodlaw is sought to fulfil three basic needs:

- Prevention of the transmission or the cause of a disease (health protection),
- Limitation of the scale of unfair products,
- Simplification of food marketing.

These three interrelated trends are of great importance together with the growth of large-scale food production units and wide acceptance of processed food. The concerns about food safety, compositional requirements and fair trade practices have grown as the food chain has become more extended and food products became more complex. Nowadays, because of the wide geographical distribution of food products, the failure of food safety may lead to rapid outbreaks of disease and even lethal outcomes.

Therefore, there is a pressure both for standards of hygiene and for the standard methods of sampling, analysis and testing which are essential for their regular and uniform application. In practice, standardisation is a process in which various factors should be taken into consideration. There are several types of standards in respect of:

1/ *The object standardised*: Definition, Designation, Composition, Additions, Quality, Hygiene, Pesticide residues, Packaging, Marking and labelling, Sampling, Analysis and testing;

2/ *The means by which standardisation is achieved*: Permissive, Mandatory, Prohibitory, Presumptive, Recipe;

3/ *The degree of standardisation sought*: Complete, Partial, Minimum, Platform, Trading, Commercial;

4/ *The binding force of the standard*: Statutory or legal, Voluntary, Draft, Temporary, Target;

5/ *The field of application of the standard*: Factory, Contractual, National and International (Townshend, 1967).

3.1 EUROPEAN UNION LEGISLATION

The EU is in the middle of standardisation programme. This programme is necessary to achieve one of the basic goals of the EU - the creation of the Common Market. Under the new approach, which started in 1985, the EU provides only general standards and then relies on the Member States to continue with the detailed regulations.

The EU seeks the elimination of the technical barriers through the adoption of EU wide standards in all areas. Therefore, there are general standards applicable to a whole range of products, called 'horizontal standards' and also many detailed standards concerning a specific product, called 'vertical standards'. Additionally, according to the European Court of Justice Decision of Cassis de Dijon, all products meeting the standards of the country of production must be accepted in other Member States. That means that Member States should develop detailed vertical standards, as to minimise technical barriers to trade and also to ensure fair competition.

The EU policy goes beyond defining uniform product characteristics, minimum safety and quality standards. Its standards include the goal of promoting competition-to-the-merits of a product, which means competing by marketing products whose attributes have social value and therefore are a kind of consumer protection policy (Travelline, 1993). A good example of the nature of competition-on-the-merits standards are the EU regulations concerning chocolate products and they are ones of a few which are considered to be fully developed. The examination of the regulations related to chocolate products presents a good picture of how the European Common Market may look in the future and also the philosophy behind EU regulations. The most important Directives related to chocolate aspects are presented below.

3.1.1 Chocolate Directive

The example of vertical standard in the EU legislation is the Council Directive **1973/241/EEC** in which chocolate products are called by a specific name

on the base of minimal compositional requirements. Minimal purity requirements and sampling methods are also prescribed (Council Directive, 1973).

'Annex 1' defines many cocoa products such as: cocoa beans, cocoa nibs, cocoa mass, cocoa fat, chocolate, milk or plain chocolate, chocolate flakes, gianduja nut chocolate, couverture milk chocolate, vermicelli or drinking chocolate and many more. Several of the amendments refine these definitions by stating the different categories in various languages, which is needed since some products are known by many names.

The examples of the more detailed definitions are:

- ***Chocolate*** is defined as the product obtained from cocoa nib, powder and sucrose with or without added cocoa butter, having a minimum dry cocoa solids content of 35 %, at least 14 % of dry non-fat cocoa solids and 18 % of cocoa butter,
- The ***plain chocolate*** should contain a minimum total dry cocoa solids content of 30 %, at least 12% of dry non-fat cocoa solids and 18 % of cocoa butter,
- The ***milk chocolate*** should have the following characteristics: total dry cocoa solids content not less than 25 %, at least 2,5 % of dry non-fat cocoa solids, a minimum total dry milk solids of 14 %, a minimum total fat of 25 % in which at least 3,5 % of butter fat and sucrose content of not more than 55 % (Council Directive, 1973).

More detailed definitions of Annex 1 products are given in Table 3.1.

Tab.3.1. Compositional requirements for chocolate; cocoa and chocolate regulations (minimum %)

	TOTAL DRY COCOA SOLIDS	DRY NON-FAT COCOA SOLIDS	COCOA BUTTER	FAT	MILK SOLIDS	MILK FAT	SUCROSE (MAX.%)
Chocolate	35	14	18	-	-	-	-
Plain chocolate[a]	30	12	18	-	-	-	-
Milk chocolate A[a]	25	2,5	-	25	14	3,5	55
Milk chocolate B[a]	20	2,5	-	25	20	5	55
Couverture chocolate[a]	35	2,5	31	-	-	-	-
Couverture Milk chocolate	25	2,5	-	31	14	3,5	55
Gianduja nut[a]							

chocolate	32[c]	8[c]	-	-	>5[g]	-	-

Tab.3.1. continued'

Gianduja nut[a] milk chocolate	25[d]	-	-	-	10[d]	-	-
Cream chocolate[a]	25	2.5	-	25	3,<14[e]	7	55
Skimmed milk[a] chocolate	25	2.5	-	25	14	0,<3.5[f]	55
White chocolate[a]	-	-	20	-	14	3.5	55
Chocolate vermicelli	32	-	12	-	-	-	-
Milk chocolate vermicelli	20	-	-	12	12	3	66

So: Kirk, Sawyer, 1991

[a] Filled chocolates; consist of a filing (except flour confectionery or biscuits) wholly or partly enclosed in 25% (min.) of one or more of the chocolate product indicated.

[b] Sucrose may be replaced by an equal amount of dextrose, fructose, lactose or maltose or by any combination to a maximum of 5% of the total weight of the product (except for dextrose alone when the maximum level of replacement is 20% of the total weight of the product).

[c] Calculated on the weight of product excluding nuts. The product must contain finely ground hazel nut (20% min., 40% max.); may contain almonds, hazel nuts and other nuts either whole or broken to a maximum of 60% total nut content in the whole product.

[d] As for [c] above except that the minimum ground hazel nuts is 15%.

[e] Minimum and maximum levels for milk solids not fat.

[f] Minimum and maximum levels for milk fat.

[g] The dry milk solids should contain not more than 1.25% butterfat.

Annex 1 covers also the permitted treatment of the cocoa butter, the substitutes of sucrose and allows the addition of a pure vegetable lecithin in specified quantities. Apart from that, the addition of edible substances is considered. The act states "the exception of flour and starches and of fats and fat preparations not derived exclusively from milk". The exception statement is not solving the current problems arising around this topic.

The following Table 3.2. shows the permitted edible ingredients in prescribed chocolate products. The whole provision applies to chocolate, plain chocolate, milk chocolate, cream chocolate, skimmed milk chocolate, white chocolate, couverture chocolate and couverture milk chocolate. The exception is paragraph (2) which does not apply to couverture chocolate and couverture milk chocolate.

Tab.3.2. Permitted edible ingredients in prescribed chocolate products (%)

PERMITTED EDIBLE INGREDIENT	MIN.	MAX.
1. Any edible substance in clearly visible and discrete pieces, except flour or starch added as such or any fat preparation not derived exclusively from milk.	5	40
2. Any edible substances not in clearly visible and discrete pieces, except for flour or starch added as such, sucrose, dextrose, fructose, lactose, maltose or any fat or fat preparation not derived exclusively from milk; or	-	30
3. Any vegetable fat or preparation of vegetable fat not derived from cocoa beans or parts of cocoa beans; or	-	**5**
4. Any partial coating or decoration; or	-	10
5. Any combination of one or more of the substances specified in (1) above with one or more of the substances specified in (2) to (4) provided the specified maximum limits are not exceeded; or	-	40
6. Any combination of two or more substances specified in paragraphs (2) to (4) provided the specified limits are not exceeded.	-	30

So: Kirk, Sawyer, 1991

3.1.2 Labelling Directive

Several horizontal regulations are applied to the sales of chocolate. The **1979/112/EEC** Council Directive details labelling, presentation and advertising requirements for all foodstuffs, including chocolate products. This Directive focuses on providing consumer with product composition and characteristics (Council Directive, 1979, b).

At first, the Directive prescribes exactly when a particular characteristics may be attributable to a foodstuff such as composition, nature, durability, place of origin or method of production. Second, the name under which a foodstuff may be sold is restricted, mainly by referring to the vertical regulation governing the particular product. Third, the Directive requires that ingredients must be listed. In special situations, such as when a low quantity of a certain ingredient is claimed, special provisions are considered. Also the date of minimum durability is required.

3.1.3 Hygiene Directive

Council Directive **1993/43/EEC** of 14 June 1993 indicates the general rules for the hygiene of foodstuffs. Also the principles used to develop the system of Hazard Analysis and Critical Control Points (HACCP) are developed as well as general requirements for food premises outlined (Council Directive, 1993).

3.1.4 Price Indication Directive

Another Council Directive **1979/581/EEC** concerns price indications on foodstuffs. The unit pricing of foodstuffs is required, so that consumers can easily make comparisons (Council Directive, 1979, a).

3.1.5 Weight Directive

Price transparency is also considered in the Council Directive **1976/211/EEC**, where prepacked products are stated to be sold in certain quantities only.

The above standards concerning chocolate products illustrate the previously mentioned ‘competition-on-the-merits’ strategy. Vertical standards are set out in great detail and they state the minimum cocoa content of various chocolate products. The Chocolate Directive even regulates the right to use the name of chocolate in case of underlining the quality, and states that: “the main name of ‘chocolate’ and ‘milk chocolate’ may be supplemented by declarations or adjectives relating to quality only if the chocolate has a total dry cocoa solids content of at least 43%, including at least 26% of cocoa butter...”. That means that imitation chocolate products must not contain the word ‘chocolate’. Also the higher milk solids version cannot be called milk chocolate in European Union unless it also contains a relatively high level of cocoa solids (> 30%). However, this version is allowed for the UK and Ireland.

Table 3.3 demonstrates the typical differences between the UK and Continental Europe composition of chocolate. For economic reasons the industry has developed the use of other vegetable fats, such as cocoa butter substitutes (CBS) and cocoa butter equivalents (CBE). Generally, they are tailored to simulate the properties

of genuine cocoa butter. These can be butteroil and vegetable fats (coco-oil, palmoil) allowed only in small quantities (maximum 5%). In specific, while CBS's, like Borneo Tallow, Shea Butter, Illipé Butter, Malabar Tallow or Chinese Tallow, are similar to cocoa butter but do not compete in blending with it, CBE's are compatible products for blending in any proportion with this cocoa butter (Huyghebaert *et al*., 1995).

Tab.3.3. The composition of the UK and continental European chocolate (%)

	THE UK		**EUROPE**	
	Milk	**Plain**	**Milk**	**Plain**
Sucrose	45	55	45	45
Skimmed milk powder	-	-	5	-
Cocoa liquor[a]	12	32	16	45
Milk fat	-	3	-	-
Cocoa butter equivalent (CBE)	5	5	-	-
Cocoa butter	9.5	4.5	19.5	9.5
Lecithin	0.5	0.5	0.5	0.5

[a]Cocoa liquor, known as cocoa mass, is a semi-plastic substance made from the roasted nibs of cocoa beans which contains 50-58% of fat i.e. cocoa butter

So: Kirk, Sawyer, 1991

In spite of the fact, that the use of such fats has been the subject of controversy, the European Commission plans to change the legislation on vegetable fats and tends to allows a higher percentage of them in real chocolate. That can have negative consequences like difficulties for a potential consumer to determine the differences in quality or decrease of the international quality image of the European chocolate.

Concluded, it may be said that chocolate is one of few foods to be strictly described in law by recipe or composition. Within the EU, chocolate was one of the first foods which is controlled by a complex and at least nine times amended Directive 1973/241.

3.2 NATIONAL LEGISLATION

3.2.1 Legislation in Belgium

3.2.1.1 General requirements

General requirements related to food safety and quality are developed at national level. These are direct implementations of the European Union's directives like horizontal standard **'Wet betreffende de veiligheid van de consumenten'** (1994), i.e. Law on Consumer Safety, which is based on the Council Directive **92/59/EEC** of 29 June 1992.

The Belgian vertical standard related to chocolate is entitled **'Koninklijk Besluit betreffende cacao en chocolade'** (1975), i.e. Royal Decision on Cacao and Chocolate, and is based on the EEC document of 25 March 1957. The Royal Decision covers 28 definitions of chocolate products and semi-products; permissible processing methods; the allowed conditions under which the chocolate products may or may not be sold; names of the products and the same compositional specifications as in the Council Directive 1973/241; labelling obliged; weights allowed and also describes penalties which may be introduced.

It is important to mention here, that **CAOBISCO** operates in Belgium as the organisation of Confectionery Trade Associations within the EC. At the same place the **International Office of Cocoa, Chocolate and Confectionery (IOCCC)** is operating and has attempted an international classification of chocolate products. It has adopted four categories of finished chocolate products such as:

- Solid chocolate
- Filled chocolate
- Pralines/ bon-bons
- Others (Nuttall, 1994)

Belgium like each country with a trade association defines or will define in the nearest future its industry in general terms. Collecting data about the industry from Member States allows to adopt classification which will suit the whole EU purposes.

3.2.1.2 Factory standards

Factory standards, being of a private nature, are not normally published and may contain trade secrets. They are generally much more detailed then corresponding public standards. Main chocolate manufacturers like Callebaut or Suchard Jacobs / Côte d'Or used to issue, for internal use, some 'contractual standards' which are ones agreed by contracts between buyer and seller for the specific purpose of the consignment. These are legal standards, but valid only between the parties to the contract.

As the composition is strictly determined in the EU law, the above mentioned companies claim keeping standards and do not use prohibited substances like hydrogenated milkfat or milk proteins. In the view of the Belgian law, modified milkfat is not legally considered as a milkfat but as a cocoa butter replacement (CBR), and is prohibited for 'real' chocolate.

Major Belgian companies like Callebaut or Côte d'Or create a strong image of high quality products and continue with the traditional dairy ingredients, such as whole milkpowder and/ or a mixture of skimmed milkpowder and milkfat. One should also keep in mind that the same companies, while producing according to the 'contractual standards', may add some dairy products such as: whey powder - to reduce sugar and chocolate liquor as well as enhance fat bloom resistance (Alikonis, 1972) or malted milk - to enhance unique flavour characteristics (Campbell, Pavlasek, 1987).

On the other hand, smaller companies are used to replace the skimmed milk powder by mixtures of partially demineralised whey or caseinates. The main reason for that replacement is to lower costs. The fact that these replacers are subsidised in the EU means that replacement results in lower costs (Viaene *et al*., 1993, b). These companies will certainly go into the direction of lower prices and thereby lower quality and changed composition of chocolate products. In the view of Belgian law the label „chocolate" should not be available for such products. However, the trend is strong and especially exists in the own brands, so-called private labels.

3.2.1.3 Analytical methods for chocolate evaluation in Belgium

The list of analytical methods found in the file of the International Office of Cocoa, Chocolate and Confectionery contains about 45 standard methods (Tab. 3.4). However, after the visit to the independent laboratory for chocolate evaluation and also some interviews with the Quality Control Managers of the companies like Callebaut or Côte d'Or, it may be concluded that these standards are not fully followed.

It means that all companies and independent laboratories developed their own analytical methods for chocolate products. The example may be the „Semi-Micro Determination of Butter Fat in Fat Mixtures by Gas Chromatography" which is performed by the Central Laboratory of the Ministry of Economic Affairs in Brussels. Majority of methods, for determination of sugars in chocolate products, is based on High Performance Liquid Chromatography and is developed independently by laboratories of each company or governmental institutions.

Tab.3.4. Analytical methods of chocolate products evaluation in Belgium

NO.	YEAR	METHOD
1	1962	Sampling (Cocoa Powder, Bars of Chocolate, Cocoa Mass Block of Chocolate and Cocoa Butter)
2	1963	Organoleptical Examination (Cocoa Powder)
3	1952	Moisture (Oven Method)
4a	1973	Ash in Cocoa and Chocolate Products
5	1973	Cocoa Beans
6a	1972	Total Nitrogen (Protein) in Cocoa and Chocolate Products
6b	1973	Milk Protein in Chocolates (AOAC Method)
6c	1963	Milk Protein (acc. to G.R. Jansen)
8a	1972	Total Fat in Cocoa Product (HC Hydrolysis Method)
8b	1962	Melting Point of Cocoa Butter
8c	1965	Cocoa Butter Indices and their Determination (IUPAC - Methods)
8d	1973	UV-Extinction Values for Cocoa Butter
9	1972	Electrometric pH - Cocoa and Chocolate Products
10	1973	Viscosity of Chocolate - Casson Yield Value and Casson Plastic Viscosity
11	1963	Calorimetric Determination of Cocoa Pigments
12	1964	Transfer of Packaging Odours to Cocoa and Chocolate Products
13	1970	Cocoa Powder Fineness

14	1970	Total Sterol Determination
15	1971	Manufacturing Process for Small Scale Chocolate Samples
16	1973	Gas liquid Chromatographic Analysis of Sterols of Cocoa Butter
17a	1973	Preparation of Methyl Esters of Cocoa Butter Fatty Acids

Tab.3.4. continued'

17b	1973	Analysis of Methyl Esters of Cocoa Butter Fatty Acids by Gas Liquid Chromatography
101	1988	Microbiological Examination of Chocolates and other Cocoa Products
102	1988	Unsaponifiable Matter in Cocoa Butter
103	1988	Alkalinity of Soluble and Insoluble Ash in Cocoa and Chocolate Products
104	1988	Water-insoluble, Water-soluble and Acid-insoluble Ash in Cocoa and Chocolate Products
105	1988	Moisture (Karl Fisher Method)
106	1988	Wettability of Instant Cocoa Powder in Water
107	1988	Purines in Cocoa and Cocoa Products
108	1988	Determination of "Blue Value"
109	1988	Content of Ammoniacal Nitrogen in Cocoa Beans and in Unalkalized Cocoa Mass
110	1988	Cooling/ Solidification Curve of Cocoa Butter and of other Fats used in Chocolate and Confectionery Products
111	1990	Mono-Oleo disaturated Symmetrical Triglycerides (SOS) in Oils and Fats used in Chocolate and Confectionery Products by Thin-Layer Chromatography and Gas-Liquid Chromatography
112	1989	D-Sorbitol in Chocolate and Sugar Confectionery Products by Means of Sorbitol-Dehydrogenase
113	1989	Glucose, Fructose and Sucrose in Chocolate and Sugar Confectionery Products by Means of Enzymes
114	1990	Lactose in Chocolate and Sugar Confectionery by Means of Enzymes
115	1990	Fat Content of Cocoa Powder by Soxhlet Extraction
116	1990	Sieve Residue of Cocoa Powder and of Cocoa Mass (Water Sieving Method)
117	1989	Sugars in Chocolate and Sugar Confectionery Products by Means of High Performance Liquid Chromatography (HPLC)
118	1990	Microbiological Examination of Chocolate and other Cocoa Products
119	1990	Red Colour Value of Cocoa Beans by Spectroscopy

So: CAOBISCO, IOCCC, 1995

3.2.2 Legislation in the United Kingdom

3.2.2.1 General requirements

The basic documentation file of British food industry covers the following documents (The Food Safety Directorate, 1995):

- **The Emulsifiers & Stabilisers in Food Regulations** 1980
- **The Miscellaneous Additives in Food Regulations** 1980
- **Weights and Measures Act** 1985
- **Food and Environment Protection Act** 1985
- **The Food (Revision of Penalties) Regulations** 1985
- **Consumer Protection Act** 1987
- **The Materials and Articles in Contact with Food Regulations** 1987
- **Food Safety Act** 1990
- **Food Labelling Regulations** 1990
- **Food Hygiene Regulations** 1990
- **Guidelines on The Food Hygiene Regulations** 1991
- **The Food Safety (Exports) Regulations** 1991

One of the most important among them is the Food and Safety Act 1990 (FSA) which was introduced to strengthen and update law on food safety and consumer protection. Most of the provisions of the Act came into force on 1 January 1991. The Act covers a broad range of commercial activities related to food itself, to the sources from which food is derived, and to the articles which come into contact with food. However, it is important to remember that one will not find detailed technical rules regulating specific aspects in the Act itself, because the Act gives only the Government power to make regulations on detailed matters.

The main offences stated hereby are:

1. „Selling, or possessing for sale, food which does **not comply with food safety requirements**,
2. Rendering food **injurious to health**,
3. Selling, to the purchaser's prejudice, food which is **not of the nature, substance or quality** demanded,
4. Falsely or **misleadingly describing** or presenting food" (FSA, 1992).

The demand for the highest standards of hygiene for those involved in food manufacture is very strong and requires professional and structural approach to food hygiene. Therefore, HACCP systems are important in the achieving and maintenance of satisfactory standards of hygiene, and can help to provide a defence of ”due diligence” required by the Food Safety Act 1990. Most of the big food companies introduced HACCP being obliged to do so or, like those which cannot afford it, are operating through various quality systems such as BS 5750.

The Act, according to the EU directive emphasises that food companies should develop training programmes for staff “commensurate with their work activity”. It is expected that, in the nearest future under provisions of the new legislation, the procedure of maintenance and regular updating of training records will be a requirement. Under this Act also, the prosecutions against companies for failing to maintain satisfactory hygienic environmental conditions can bring fines of up to Ł2,000 per offence. Food contamination offences can lead to fines of up to Ł20,000 for each offence.

Not only the effective staff training in food hygiene and HACCP procedures are considered to be crucial. The following schemes are also of great importance: proven (documented) maintenance, cleaning and pest-control, self-auditing systems, procedure for customer enquiry handling and finally establishment of sound liaison with local environmental health departments. Additionally, it is very important to develop an understanding of the requirements of the new EU directives which might be in some way achieved by usage of the voluntary Industry Guides to Good Hygiene Practice. Such guides are drafted by industry according to the relevant codes of practice and there is no legal requirement to follow a particular guide.

England developed its own law on chocolate i.e. **The Cocoa and Chocolate Products Regulations 1984** that implements the Council Directive 1973/241/EEC on the approximation of the laws of the Member States relating to the cocoa and chocolate products (The Food Safety Directorate, 1995).

3.2.2.2 Classification

Over 50 countries, mainly European, use the IOCCC Nomenclature of chocolate products classification which was previously mentioned. The EU Customs and Commission system deals with the following groups of products:

- Sweetened cocoa powder
- Unfilled chocolate
- Filled tablets and bars
- Filled chocolates and chocolate confectionery
- Other chocolate products
- Sugar confectionery containing cocoa (Nuttall, 1994).

However, in 1988 England developed the British classification of chocolate products as to facilitate comparison of statistical data and customs requirements. It specifies (Nuttall, 1994):

- Solid milk or blended chocolate in blocks etc., with addition of discrete particles embedded in the chocolate
- Solid milk or blended chocolate without additions, in blocks etc.
- Filled blocks, bars and countlines with a continuous or segmented layer of biscuit or wafer
- Solid plain chocolate, with or without additions
- Filled blocks, bars, and countlines, other chocolate assortments in bite-sized pieces
- 'Straight' lines, i.e. collections of bite-sized pieces identical in nature
- Chocolate liquors
- Chocolate novelties such as Easter eggs, Bouchées etc.

3.2.2.3 Analytical methods for chocolate evaluation in the United Kingdom

Non-statutory methods on cocoa and chocolate products are collaboratively tested by the Ministry of Agriculture Fisheries & Food (MAFF) and contain, among others, the following methods (Tab.3.5).

Tab.3.5. Methods of chocolate analysis based on English foodlaw

REFERENCE: JOURNAL OF THE ASSOCIATION OF PUBLIC ANALYSTS	TITLE
1992, **28(2),** 63-67	Moisture in Cocoa & Chocolate Products
1992, **28(2)**,69-72	Ash in Cocoa & Chocolate Products
1992, **28(2),** 73-77	Unsaponifiable Matter in Cocoa & Chocolate Products
1992, **28(2),** 79-82	Acidity in Cocoa & Chocolate

	Products
1992, **28(2),** 83-88	Total Fat in Cocoa & Chocolate Products
1992, **28(2),** 89-94	Milk Fat in Cocoa & Chocolate Products

So: MAFF, 1996

3.2.3 Legislation in Poland

3.2.3.1 General requirements

Polish file of general requirements related to food is presented below. It is a free translation of all directives and regulations, as the author did not have access to the professional nomenclature of the subject.

- Directive on „**Healthy conditions of food and nutrition**"; of 25 November 1970,
- Directive on „**Quality control of foodstuffs** in terms of health and **hygiene** in manufacturing plants and retailers"; of 21 July 1971,
- Requirement of the Ministry of Health and Social Care on „**Quality control of foodstuffs imported** in terms of health"; of 31 January 1972,
- Regulation of the Ministry of Health and Social Care on the „**Permissions for production**, introduction to retail and importation of chosen foodstuffs"; of 17 December 1973,
- Regulation of the Ministry of Health and Social Care on the „Required conditions of drinking and production **water"**; of 31 May 1977,
- Requirement of the Ministry of Health and Social Care on the „**Additional substances allowed** and technical media in foodstuffs"; of 31 March 1993,
- Directive on "**Normalisation"**; of 3 April 1993,
- Directive on „**Weight** allowed"; of 3 April 1993,
- Regulation of the Ministry of Agriculture and Food on the „**Obligatory status of Polish Norms"**; of 18 March 1994,
- Regulation of the Ministry of Agriculture and Food on the „**Obligatory status of Branch Norms"**; of 18 March 1994,
- Regulation of the Ministry Agriculture and Food on „Fixing a list of obligatory products to be claimed for certification of **safety mark** and labelling by that mark"; of 30 May 1994,
- Regulation of the Ministry of Agriculture and Food on the „**Labelling of foodstuffs**, and additional substances allowed to be introduced into retail"; of 12

July 1994,

- Regulation of the Ministry Agriculture and Food on „Detailed conditions of **customer contracts** related to selling of mobile goods with the consumers' share"; of 30 May 1995,
- Directive on the „Change of Directive on normalisation"; of 8 June 1995,
- Polish Norms (PN) and Branch Norms (BN) relating to **quality requirements and methods of examination of confectionery products**, raw materials and packaging.

In that list of the basic Polish directives and regulations concerning foodstuffs, a few issues should be pointed out. Basically, quite a few of the above regulations are of recent dates. First, in the order of importance, is the requirement on the additional substances allowed in foodstuffs. This requirement increases number of additional substances by about 35%, and therefore is closer to the requirements of EU, Codex Alimentarius and a list of FAO/WHO (Szponar *et al.*, 1994).

The second one is a new regulation on the labelling (Rozporządzenie w sprawie znakowania, 1994) which is designed and in majority similar to the amended version of Directive from 1979/112/EEC.

It is necessary to emphasise that in the view of new legislation the regulations on the introduction of Polish Norms (Polish standards) and Branch Norms (Sector standards) are not longer compulsory according to the regulations on the obligatory status of Polish Norms and Branch Norms of 1 January 1994. Sector standards (BN) should be transformed into Polish standards (PN) until the end of 1997 according to the Directive of 8 June 1995 (Ustawa o zmianie ustawy o normalizacji, 1995). New Polish standards based on ISO requirements (PN-ISO standards) are being prepared.

There is also a new project on Polish Norms' development concerning chocolate which is already being checked by the **Polish Normalisation Committee**. New norms in food industry will be elaborated in a uniform manner but the whole process of their preparation and application to the quality control systems will take some time.

Additionally, **Polish Centre of Research and Certification (PCBC)** has been created which according to the Directive on Research and Certification of 1st January 1994 aims to liquidate technical barriers in trade, increase competition between products and services and facilitate local and international turnover.

On the other hand, norms related to the quality of food in terms of health are still obligatory in the whole food business.

3.2.3.2 Analytical methods for chocolate evaluation in Poland

In the Agri-Food Business there are approximately 600 Polish Norms (PN) and over 1000 Branch Norms (BN) established (Marcinek, 1993). There were also few thousands of Factory Norms (ZN) which are withdrawn from the official use in view of new legislation.

The central institution responsible for the whole normalisation process is the **Polish Normalisation, Measurement and Quality Committee (PKNMiK)** which was created on 29 March 1972.

In December 1991 Poland went into the 'European Pact' with European Union which covers the agreement on the aimed harmonisation of food regulations in Poland with those obligatory in the EU. From November 1992 Poland also takes part in several Technical Committees of the International Standard Organisation, including four of them related to foodstuffs.

Chocolate is included in so-called „Durable Confectionery Products" group and standards (norms) for its examination are presented below.

Tab.3.6. Polish standards (PN) related to chocolate evaluation

		CONFECTIONERY AND BAKERY PRODUCTS	
CLASS NO.	***GROUP NO.***	***NORM'S NO.***	***SUBJECT***
124	1240	***Terminology. Classification.***	
		A-88000 93	**Terminology** (in force from 1/1/1994)
		A-88001 75	**Classification** (1/1/1976)
	1249	***Receipt instructions. Methods of tests. Packaging. Marking. Storage. Transport.***	
		A-74858 73	**Sampling** (1/1/1974)
		A-88021 71	Determination of **Fat** Content (1/1/1972)
		A-88022 59	Determination of **Ash** Content (1/10/1960)
		A-88023 61	Determination of **Sugar**s (1/12/1961)
		A-88024 79	Determination of **Acidity** (1/1/1980)
		A-88026 81	Determination of **Alcohol** (1/1/1982)
		A-88027 84	Determination of **Dry Matter** Content (1/1/1985)
		A-04010 59	Determination of **Arsenic**
		A-04011 80	Determination of **Lead**
		A-04012 80	Determination of **Copper**
		A-04013 59	Determination of **Zinc**
		A-04014 80	Determination of **Tin**

So: Katalog Norm Polskich, 1994

Additionally, standards of confectionery industry called „Branch Norms" are collected in the following table:

Tab.3.7. Branch standards (BN) related to chocolate evaluation

		CONFECTIONERY AND BAKERY PRODUCTS	
CLASS NO.	***GROUP NO.***	***NORM'S NO.***	***SUBJECT***
124	1242	***Confectionery and Bakery Products***	
		8054-01 80	Determination of **Lecithin**
		8094-04 79	Determination of Chocolate Mas**s Granulation**
		8090-07 79	Determination of Chocolate Mass **Viscosity**
		8095-01 76	**Drinking Chocolate** (in force from 1/7/1977)
		8095-02 90	**Solid and Filled Chocolate** (1/3/1990)
		8094-01 87	Durable Confectionery Semi-Products. **Couverture**(1/7/1987)
		8094-08 87	Confectionery Semi-Products.

		Cacao Butter (1/7/1987)
8094-16	90	**Microbiological Examination** (1/7/1990)
8090-13	70	**Organoleptical Examination**
8090-02	76	**Determination of Colour**

So: Katalog Norm Branżowych, 1993

3.2.3.3 Classification

3.2.3.3.1 General classification

Polish classification of confectionery products is complex and according to PN-75/A-88001 covers groups, sub-groups, types and species which all depend on the common characteristics like: organoleptical features, appearance, consistency, dominating feature of raw materials or additions used, and additional flavour characteristic, as well as fillings or couvertures.

The general classification of durable confectionery products is described by symbol 2513 and may be laid down as follows:

- Confectionery Semi-Products (Couverture, Cocao Fat, Cocoa Nib, Masses from oil substances like nuts etc.)
- Candies
- **Chocolate**
- Chocolate Covered Products
- Cocoa
- Durable Bakery Products
- Oriental Products
- Imitation Chocolate Products and Products in Cocoa Couverture
- Others

3.2.3.3.2 Classification of chocolate and chocolate products

According to Polish standard entitled „Terminology" (PN-93/A-88000) more detailed classification of chocolate and chocolate products is presented as follow:

1. Chocolate
2. Solid Chocolate
3. Natural Chocolate:
    - Sweet Natural Chocolate
    - Semi-Sweet Natural Chocolate
    - Dessert Natural Chocolate
    - Bitter Natural Chocolate
4. Milk Chocolate

- Full-Milk Chocolate
- Extra Full-Milk Chocolate

5. Cream Chocolate
6. Aired Chocolate
7. Solid Chocolate with Additions
8. 'Adjective Name' Chocolate (name created from the name of addition e.g. nutty chocolate)
9. Chocolate with a Name "With Nuts" or "With Almonds"
10. Filled Chocolate
11. Drinking Chocolate
12. Chocolated Products (i.e. covered with chocolate, like candies, halva, bakery goods etc.), (PN, Wyroby cukiernicze trwałe. Terminologia, 1993)

3.2.3.4 Compositional requirements

Table 3.8 shows the example of compositional standard for solid chocolate with or without additions (e.g. nuts, fruit) which is based on '**Solid and Filled Chocolate'** standard (BN, Czekolada pełna i nadziewana, 1990).

3.3 CODEX ALIMENTARIUS STANDARDS

International Codex Alimentarius Commission is a principal organ of a worldwide food standards programme and works under the joint FAO/ WHO auspices. The purpose of Codex Alimentarius is:

> „... to guide and promote the elaboration of definitions and requirements for foods, to assist in their harmonisation and, in doing so, to facilitate international trade" (Miller, 1995).

Codex has been developed by an International Commission established in 1962 when the Food and Agriculture Organisation (FAO) recognised the need for international standards as to guide world's growing food industry and to protect the health of consumers. Since it was established in 1962, the Codex Alimentarius

Commission has produced sets of various principles, guidelines and standards which are bound into 28 volumes and include 237 food commodity standards (Miller, 1995). They also enclose 41 hygienic and technological practice codes. All of them contain „requirements for food aimed at ensuring the consumer a sound, wholesome food product free from adulteration, correctly labelled and presented" (Miller, 1995).

There are 28 subsidiary bodies within Codex, the seven so-called general subject committees work closely with scientific bodies in developing the standards and recommendations. Eighteen commodity committees operate from time to time and six of them are still active, while 11 have been adjourned without setting new meeting dates, and one has been dissolved. Among the adjourned committees is the committee on cocoa products and chocolate.

The twelve categories covered in the 237 Codex commodity food standards are listed below, in order in which they appear in Codex documents:

- Processed fruits and vegetables and edible fungi
- Sugars
- Processed meats, poultry and bouillons and consommés
- Fish and fishery products
- **Cocoa products and chocolate**
- Quick frozen fruits and vegetables
- Fruit juices, concentrated fruit juices and fruit nectars
- Edible fats and oils
- Milk products
- Cereals, pulses, legumes and derived products
- Edible ices and ice mixes
- Vegetable proteins

Within Cocoa Products & Chocolate category the following standards can be differentiated:

Tab.3.9. Codex Alimentarius Standards for chocolate and chocolate by-products

SUBJECT	CODEX STANDARD
1. Cocoa Butters	86-1981
2. Chocolate	87-1981
3. Cocoa Powders (cocoa) and Dry Cocoa-Sugar Mixtures	105-1981
4. Cocoa (Cacao) Nib, Cocoa (Cacao) Mass, Cocoa Press Cake and Cocoa Dust (Cocoa Fines), for use in the manufacturing of Cocoa and Chocolate Products	141-1981
5. Composite and Filled Chocolate	142-1983

So: Kirk, Sawyer, 1991; Codex Alimentarius, 1994, a, b, c, d

Additionally, Codex Alimentarius Commission developed methods for evaluation of chocolate products:

Tab.3.10. Methods of chocolate evaluation developed by Codex Alimenterius

COMMODITY STANDARD	PROVISION	METHODS	PRINCIPLE	TYPE
Chocolate 087-1981	Copper	AOAC 960.40	Colorimetry, diethyldithiocarbama -te	II
Chocolate 087-1981	Fat-free cocoa solids	AOAC 931.05	Oven evaporation and factor	I
Chocolate 087-1981	Lead	AOAC 986.15 (E)	Colorimetry, dithizone	II
Chocolate 087-1981	Moisture content/ Loss on drying	AOAC 931.04 OICCC 3E (1952)	Gravimetry	I
Chocolate 087-1981	Percentage of cocoa butter	AOAC 963.15 OICCC 8a (1972)	Soxhlet extraction	I
Chocolate 087-1981	Total ash	AOAC 972.15	Gravimetry	I
Chocolate 087-1981	Total ash	AOAC 963.15	Gravimetry/ Soxhlet extraction	I
Cocoa products and chocolate 960	Arsenic	AOAC 952.13 Codex general method	Colorimetry, diethyldithiocarbama -te	II

Tab.3.10. continued'

Composite and filled chocolate 142 - 1983	Centre in composite and filled chocolate	Method described in ALINORM 83/23, p. 27	Gravimetry	III
Composite and filled chocolate 142 - 1983	Coating in composite and filled chocolate	Method described in ALINORM 83/23, p. 27	Gravimetry	III

So: Codex Alimentarius, 1994, e

Generally, Codex Alimentarius enclose the general hygiene and safety requirements in food production which should be treated as informative material helping the producers or governmental institutions.

3.4 STANDARDS OF THE INTERNATIONAL STANDARD ORGANISATION (ISO)

International Standard Organisation (ISO), was found in 1946 and developed a common set of manufacturing, trade and communication standards. That Swiss-origin organisation is composed of 91 members and is structured into 183 technical committees, 630 sub-committees and 1,830 working groups (Knebl, 1995).

In 1987, ISO prepared norms ISO 9000 - 9004, which had their reflection in the European Norms EN 29000 - 29004 of 1990. These standards known as the ISO 9000 series were promulgated in 1987 and revised in 1994. The next major revision is set for 1999. There are basically five standards associated with the ISO 9000 series. These are:

1. „**ISO 9000**: The set of guidelines for the selection and use of the appropriate system standards ISO 9001, 9002 and 9003.
2. **ISO 9001**: The most comprehensive quality assurance model in the series. To be used for companies involved in the design and development, production, installation and servicing of a product or service.
3. **ISO 9002**: The model for quality assurance without the design and development aspect. Identical to ISO 9001 in every other aspect.
4. **ISO 9003**: The model for quality assurance for companies involved in final inspection and testing. These involve stocklist, distributors or contractors.
5. **ISO 9004**: A series of application interpretations for the standards. i.e. ISO 9004 - is a guideline for service industries that can be used in combination with ISO 9001, 9002 or 9003" (Knebl, 1995).

Searching for the ISO standards related to the chocolate products, one may find (ISO Catalogue, 1995) the following four standards concerning examination of cocoa beans:

- **Sampling** (ISO 2292:1973),
- **Specification** (ISO 2451: 1973),
- **Cut test** (ISO 1114:1977),
- **Determination of moisture content** (ISO 2291:1980).

There are no standards for chocolate and it can be guessed why - because of the fact that the quality of cocoa beans seems to be only of great importance or may be because they are not fully developed by ISO for the time being. The process of harmonisation of foodlaw is still in progress. However, we should not expect much for the reasons explained in the Quality Control chapter.

3.5 EUROPEAN COMMITTEE FOR STANDARDISATION (CEN)

The another important to mention institution dealing with standardisation of food issues is CEN - the European Committee for Standardisation. CEN is the Association of the European National Standard Bodies created for purpose of :

> „implementation of standardisation throughout Europe to facilitate the exchange of goods and services (Statutes, Art.4)”, (CEN, 1995).

The national members of CEN organisation are among others: British Standard Institution, Belgian Institute of Normalisation/ Institut Belge de Normalisation as well as the Polish Committee of Normalisation/ Polski Komitet Normalizacyjny which has been the affiliated body of CEN since November 1991 (Marcinek, 1993). These three mentioned institutions work in Food Sector that is only one among twelve other sectors like: gas, environment, post, railway, information technology, transport and packaging or healthcare. In the Food Sector, the Programming Committee, PC 4, continues to stress the need for harmonisation of analytical and sampling methods in Europe.

3.6 COMPARATIVE SYNTHESIS OF NATIONAL AND INTERNATIONAL LEGISLATION FOR CHOCOLATE INDUSTRY

The United Nations aim to promote international trade throughout the development of generally accepted food standards. The organisations involved are: the Food and Agriculture Organisation (FAO), the World Health Organisation (WHO) and the joint Codex Alimentarius Commission. These bodies developed the recommended international standards which are published for the individual foods such as cocoa products.

Among other bodies interested in development of analytical methods is International Standard Organisation (ISO). Much attention has been given to the establishment of a common sampling terminology in recognition of the need to obtain international agreement on enforcement standards.

The Treaty of Rome gives the European Union Institutions the powers and procedures necessary to achieve the objective of establishing a Common Market through harmonising economic activities and the laws governing these activities. That means that each Member State of the EU may develop its own standards based on the EC directives that will involve all specific circumstances of law implementation in the country.

The laws of the Community are expressed in the form of Regulations and Directives. The essential difference is that the regulations must be incorporated into national legislation, while requirements of the Directives are enclosed into the framework of the individual legislative system of the country. In general, Regulations concern primary agricultural production and Directives deal with detailed compositional aspects of manufactured foods.

The European Communication on the Development of European Standardisation, so-called „Green Paper", states that:

> „ ... national standards tend to shape customers' preference for products. More European standardisation can gradually eliminate these hidden technical barriers to trade [that is customer preference for certain products] by building up a degree of commonality in technical specifications where the market considers it useful" (Green Paper, 1990).

Let's have a look inside the law on chocolate products of the presented countries. The UK joined the European Economic Community (EEC) on 1 January 1973, while Belgium was one of the countries contributing to the creation of EEC on 25 March 1957. Poland is in the process of economic transition, including foodlaw, and changing its structures according to the European Union requirements. Belgium developed the national law on chocolate in 1975, while England has taken part in the harmonisation activities through various regulations and acts established since 1984 (Swiercz, Czerni, 1993). The Polish standards on chocolate go back to the 1960s.

There are many differences within these three countries as far as the analytical methods prescribed by national law are concerned. A list of the analytical methods for chocolate products recommended by IOCCC contains about 45 positions and that is much more that one can find in the file of the English or Polish law on the same subject.

As a matter of fact, the UK does not have a prescriptive list of official methods for chocolate and chocolate ingredients. Under the English system of enforcement where analysis is carried out it is undertaken by Public Analyst who has to use methods which have been fully tested, and can be defended in a court of law (MAFF, 1996). The list of non-statutory methods for analysing chocolate and its ingredients, presented before, details a number of relevant methods which have been evaluated by the Ministry of Agriculture Fisheries & Food.

Polish standards are more detailed and contain about 20 analytical methods concerning chocolate evaluation. Comparing different classifications of chocolate products the following conclusion is made. Polish classification seems to be more complicated (12 items) then English and Belgian classification (8 items).

If the trend towards food law harmonisation continues, the next aspect will probably be the most important i.e. compositional requirements. The 1973 Directive on chocolate regulated the minimum content of cocoa products and milk solids as well as sugar content. However it did not regulate the use of non-cocoa based ingredients therefore several Member States permitted the use of vegetable fats in chocolate production.

It is believed that the 1973 Directive is an anachronism since in the mid-1980s, this vertical directive was replaced by a horizontal approach. The keystone of the latter was the agreement on mutual recognition of food products, including chocolate, throughout the EU. At present a strong movement towards common rules on essential requirements as product safety and labelling is observed. At the same time, only seven EU Member States allow to use vegetable fats in chocolate manufacture. However, a new proposition of the European Commission relating to the permission of CBS's usage in chocolate is put forward.

Skimmed milk ingredients are also permitted in chocolate products and include: skimmed milk, concentrated skimmed milk, evaporated skimmed milk,

sweetened condensed skimmed milk and non-fat dry matter. Studies have shown that whey and casseinates are also useful ingredients in chocolate manufacturing. In spite of the fact that some researchers claim many advantages of their application like flavour enhancement and fat bloom resistance (Alikonis, 1972), these substances are not permitted as optional ingredients in the EU chocolate standards.

Additionally, because of the economic advantages of incorporating the maximum amount of milkfat into chocolate, a number of researchers have attempted to harden milkfat by fractionation, hydrogenation and interesterifcation (De Moor, Huyghebaert, 1982). This hydrogenated milkfat has been shown to prevent fat bloom in dark chocolate (Campbell, 1969). However, the use of hardened forms of milkfat has not been legalised in major chocolate producing countries like Belgium, England, USA or Canada. Only the lower concentrations of butteroil, i.e. 1-5% of the total fat may be added to chocolate to slightly soften it and can be adjusted seasonally to produce the same textural impressions for all seasons or markets.

It should be also noted that the consumer protection must be seriously taken into account, as most consumers do not read labels and choose a particular food product just because it tastes good. However, it can taste good because it contains an excessive amount of an unhealthy taste enhancer.

Concluding, it can be said that standards for chocolate examination should be set out at a point below which any benefits to society are outweighed by costs. It means that no standard is worth to be considered if the chocolate that has been produced according to it is going to be unhealthy or too expensive. Minimum percentage of some ingredients will have immediate effect on price and that may contribute to the change in food habits.

One may notice that in many cases the idea of „higher" standard tends to become a shibboleth, being popularly quoted while producer may decrease his responsibility for the quality of food. It shall also be remembered that too many legislation procedures increase the bureaucracy and costs of production without significant advantages for a consumer.

4. LEADING CHOCOLATE MANUFACTURERS

4.1 LEADING CHOCOLATE MANUFACTURERS IN BELGIUM

4.1.1 Introduction

The chocolate industry in West Europe is dominated by large multinational firms. This is especially visible in the UK and Germany. However, in some countries like Belgium or Switzerland the smaller chocolatiers who are specialised in traditional products, such as pralines, take a large part of the total chocolate confectionery production and enjoy good profits. The strategy of large companies is usually based on non-price competition through product differentiation and wide advertising (Viaene *et al.*, 1993, a).

Just only a few data should be marked out here. Firstly, the average investments per employee in the chocolate and sugar confectionery sector during the period of 1980-1990 reached a level of around 3,663 ECU in the EU. The highest scores are found for the Netherlands (6,447 ECU) and Belgium (5,278 ECU). These figures exceeded largely the average for the entire EU sector (Viaene *et al.*, 1993, a). Secondly, growing trend towards automation in the chocolate industry is observed. It may be noted that such countries like the Netherlands, Belgium, Denmark and Greece showed the lowest share (in %) in total EU employment in confectionery industry in 1992. The highest percentage shares in total EU employment are found for Germany (30%) and the UK (28%).

4.1.2 Characteristics of the leading Belgian manufacturers and brands

The Belgian chocolate market is ruled by three large companies: Callebaut, Kraft-Suchard / Côte d'Or and Leonidas. On the list of 37 chocolate producers in Belgium the following three were the leaders in 1993:

- Callebaut with turnover of BEF 3,671.42 mln
- Kraft-Suchard Côte d'Or - BEF 2,802.93 mln
- Leonidas - BEF 1,874.99 mln (Trends Top 5000, 1994).
- **CALLEBAUT**

CALLEBAUT's origin goes back to 1850 in Wieze, where the family firm set up a brewing and dairy businesses. In 1911, the chocolate production started and in 1981 the Callebaut family sold its shareholdings to the Swiss Interfood group (Suchard / Tobler). This group was merged with Jacobs Kaffee two years later to form the Jacobs Suchard company. In 1986, Suchard Jacobs acquired Van Houten, which was integrated into Callebaut two years later. The next firm S&A Lesmé (UK) was acquired by the company in 1990. The same year Jacobs Suchard was acquired by Philip Morris and the group's industrial activities (like cooking chocolate) were purchased by Klaus J. Jacobs.

Callebaut Europe, set up in 1990 consists of two major entities situated in Belgium (Chocolaterie in Wieze) and in the UK (S&A Lesmé - Callebaut in Branbury). Additionally, Callebaut has the production and sales points in Canada (St. Hyacinthe) and the USA (St. Albans). The group has also sales and distribution centres in Germany, France and the Netherlands as well as the customer services in Hong Kong and Singapore.

It manufactures a range of solid chocolate bars and blocks for sale to the consumer but 85 percentage of its production is in the form of couverture chocolate. In 1990 about 35% of Callebaut chocolate was exported and in 1995 it was about 65%. Callebaut Wieze plant specialises in the coating chocolate and offers a range of 500 different recipes of this product including chocolate calets, chocolate strips and flakes (splitters), chocolate vermicelli and also nut products such as gianduja (hazelnut paste). From November 1995, Callebaut started to manufacture the customer products i.e., as it was mentioned above, solid and filled chocolate bars. It was observed that almost all marketing and retail stages of these new products were very effective and successful.

The company's sales in 1992 were around BEF 12.4 bln with a workforce of 652 (EIU Marketing in Europe, 1994).

- **KRAFT-SUCHARD / CÔTE D'OR**

Since its foundation in 1883, Côte d'Or was always one of the leading chocolate manufacturers in Belgium. It is best known for its distinctive and dramatic

African elephant logo and excellent quality of its products, which are positioned as a rich and fully-flavoured chocolate.

Following its successful launch on the Brussels Stock Market in 1984, the company attracted the attention of the Swiss group Jacobs Suchard. In 1987, Côte d'Or was acquired by Jacobs Suchard which in turn was taken over by the Kraft General Foods International (i.e. the US Philip Morris group) in June 1990. The integration of Côte d'Or into Jacobs Suchard led to cost savings, particularly in the marketing, financial and commercial fields but it also caused the release of 450 people, around a quarter of the workforce (KGFI, 1994).

In 1982, the company had a turnover of BEF 4.5 bln and employed 1.500 people. Over half of the total production of 35,000 tonnes was exported. That time Côte d'Or was the largest manufacturer of chocolate in Belgium. After the acquisition there was a significant increase in turnover, BEF 13.0 bln for 1992 (EIU Marketing in Europe, 1994). At the present, the company's new high productivity manufacturing plant and the increased marketing support (representing 7-15% of turnover) gives the company hope on more expansion in the nearest future.

The group has the manufacturing facilities in Halle near Brussels and also in France, Spain and Switzerland. There are subsidiaries in the Netherlands, Germany and Italy. The main product lines are filled and solid bars, enrobed candy bars (such as Zauki and Nougatti) and chocolate assortment (pralines). Some sugar confectionery is also manufactured by the company. In addition to the Halle plant, where traditional chocolate products are manufactured, the group has a facility at Herentals. The lines of such biscuit-based products as Leo and Mélocake are produced here. Suchard Jacobs has 29 factories inside Europe out of total 82 factories situated all over the world.

Côte d'Or is the most important producer in terms of consumer products therefore, it has a very strong position in the retail market. The brand „Côte d'Or" is the second largest brand behind „Milka" produced by Kraft-Suchard / Côte d'Or and contributes a 16% share of group volume (EIU Marketing in Europe, 1994). The company does not produce any couverture chocolate.

- **LEONIDAS**

Leonidas, the third largest chocolate producer in Belgium, is the most important of the Belgian manufacturers who produce the range of luxury pralines in a truly industrial scale.

The company has two factories in Brussels and a net of distribution outlets which are situated in the principal Belgian cities. There are about 13 Leonidas' shops in Brussels and over 300 independent retailers dealing with Leonidas products in the whole Belgium.

Outlets have their own typical format incorporating a counter opening straight onto the street and by that way the brands' popular appeal is reinforced. In 1992, company employed around 506 people.

4.1.3 Strategies of the Belgian chocolate manufacturers

CALLEBAUT

- Specialisation in coating (couverture) chocolate,
- In majority production according to the consumer specifications,
- Last development: customer products' orientation,
- Wideworld exportation,
- Company states: „We could manufacture chocolate products with vegetable fats but it would degrade image of company",
- Company's policy: „Promotion is not our aim, it is in the contradiction with the image of Callebaut",
- „Flexibility is our goal, we will offer 14 different products from 1 line in the nearest future",
- Certified as Kosher (Kasruth Lab. Inc. New York).

KRAFT-SUCHARD / CÔTE D'OR

- Main products: solid and filled chocolate bars, enrobed candy bars, chocolate assortment, sugar confectionery, cereal bars, individual pralines,
- Concentration on traditionally strong product fields as chocolate bars but also on specialities such as Chocotoff, Nougatti and Mignonettes,
- No production according to the consumer specifications,

- Clear differentiation between the Côte d'Or brand that retain its strong „Belgian" character and the company's Swiss brands such as Milka,
- The largest export markets are the Netherlands, which account for 30% of Côte d'Or foreign deliveries (34,000 tonnes per year). The company intends to reinforce its position in two other EU markets - i.e. Germany and Italy,
- The exportation to the Middle East and in longer term to the USA will be aimed to in the nearest future,
- Sales through duty-free outlets, which are running at 850 tonnes a year, are the another type of activity that Côte 'Or sees as internationalising its image,
- Within these products, which are mainly sold into the EU market, the addition of cocoa butter substitutes is not applied,
- Huge investments in equipment as a result of Total Quality Management.

LEONIDAS

- Specialising in industrially made pralines, which are recognised as high quality products sold at the competitive price (at around two-thirds the price of their rivals),
- Company does not export,
- Special image is created through the unique decoration and location of the retail outlets.

4.1.4 Other Belgian chocolate manufacturers

Apart from these three leading companies in chocolate industry (Callebaut, Côte d'Or and Leonidas), there are other noteworthy chocolate manufacturers in Belgium.

Goemaere is the second, much smaller than Callebaut, producer of couverture chocolate which does not supply consumer products. Another one, ***Chocolaterie Jacques***, is the relatively small producer of chocolate bars although very popular and competitive in price and quality with Côte d'Or products.

Additionally, the Belgian industry has several quite large producers of pralines such as ***Godiva***. Godiva, which belongs to the US group, Campbell Foods, is the leading producer of not only a famous hand-made pralines but also a wide

range of luxury chocolate products. The chocolate factory was founded in 1929 by the Draps family and after the Second World War the Godiva exceptional praline range, which was sold with their own branded pralines requirements, was launched. Soon after Godiva became a supplier to the Belgian court. In 1958, the first Godiva's shop was opened in Paris and that marked the beginning of the company's worldwide expansion. Nowadays, Godiva's products, in a range of 120 chocolate items, are sold in more then 200 sales points in about 25 different countries. The high luxury and delicacy products are supplied from two production centres. One of them is located in Brussels (Koekelberg) and the second on is in the USA (Reading, Pennsylvania). The strategy of the company is as follow: three-quarters of Belgian production is exported and many outlets are situated in such locations as international airports and department stores. The turnover in 1993 was BEF 420 mln, that made the seventh position on the retailing list of top Belgian chocolate producers.

However, not only Godiva and Leonidas produce delicious pralines. The ***Neuhaus*** must also be mentioned. Neuhaus, founded in 1957 claims to have invented the first filled chocolate, known as „praline" in Belgium, as well as the „ballotin", the traditional Belgian chocolate box. The company operates through 50 retail outlets in Belgium under its own name and exports to many countries in Europe and the North America, Japan and the South-East Asia. In the USA, Neuhaus has a high reputation as the largest foreign-owned private firm operating in the food sector. The strategy of the company ranges from duty-free sales and sales through the net of „patisseries" to the marketing of the other chocolate products including bars and tinned presentations and also franchising operations for drinking chocolate and ice-cream in France.

The another firm, the Italian owned chocolate group - ***Ferrero*** - operates through two establishments in Belgium. The first one is Ferrero Ardennes, in Arlon in the Belgian province of Luxembourg. This plant is a major production centre for the group and its most important products line is „Kinder" novelty range of chocolate eggs. The smaller product lines include the following brands: Leonardo, Fresca Mint and Cappucino. Other leading products of this company are: Nutella chocolate spread; liquor-filled chocolates such as Mon Chéri; Tic-Tac and also Ferrero Rocher boxed assortment.

Other important suppliers of chocolate products for the Belgian market are the multinational corporations such as ***Mars*** and ***Nestlé.*** Generally, according to Nielsen data, it may be concluded that the consumer chocolate market in Belgium is led by Jacobs Suchard, with its Côte d'Or brand. The market for the white chocolate is dominated by Nestlé. Callebaut is the leader on the market of industrial (couverture) chocolate. In the countline segment, Master Foods have 40% of the market but, Suchard brands lead the large bar (tablets) segment that account for 68% of overall production (Côte d'Or 50%, 18% for Callebaut and Milka). In the small bar (baton) segment Callebaut and Côte d'Or account for roughly 30% each. Own brands have between 10 and 20% shares of all product categories (EIU Marketing in Europe, 1994).

4.2 LEADING CHOCOLATE MANUFACTURERS IN THE UNITED KINGDOM

4.2.1 Introduction

The British chocolate sector is very large and mature. It is dominated for a long time by the three major companies: Cadbury, Mars and Nestlé Rowntree. However, since Suchards' acquisition of Terry's, there is a potential for a fourth major company that will be controlled ultimately from the American Philip Morris group.

Cadbury is an independent English company based in Bournville, Mars is of the USA origin, while Nestlé is based in Vevey. A particular feature of the English chocolate market, especially since the creation of the Single European Market on 1st January 1993, is the internationalisation of manufacture and supply within the sector.

At the moment, Europe is faced with larger retail groupings and manufacturers have enjoyed a strong position for a number of reasons like: the strength of brands over the last years, the weakness of private label products and the diversity of retail outlets that reduces a strong position of supermarkets.

4.2.2 Characteristics of the leading English manufacturers and brands

Market shares of four leading chocolate manufacturers in the UK's chocolate sector in 1993 are represented by the following data: Cadbury 28 %, Nestlé Rowntree 26%, Mars 23% and Terry's 4% (EIU Retail Business, 1993).

- **CADBURY SCHWEPPES**

Cadbury is one of the largest food manufacturers in the UK and Europe. It has two very strong core businesses in confectionery and soft drinks. The origin of the group goes back over 200 years. Jacobs Schweppes developed his process for manufacturing of mineral water in Geneva in 1783. The forty one years later in Birmingham, John Cadbury as a first started selling tea and coffee. Cocoa and chocolate, within a few years became the main business of Cadbury's firm. The two companies merged in 1969, since then there has been a continuous strategic expansion worldwide.

Cadbury Schweppes is now an international force and markets a mix of local, regional and global brands. It has manufacturing plants in 23 countries and sales in a further 156. The company is one of the best known names in confectionery. The main activity has been geared towards expanding sales of its core moulded bars, countlines and boxed assortment, which ranges across the whole Europe.

Despite Cadbury's UK confectionery leadership, in Europe the group falls to fifth position behind Nestlé, Mars, Suchard and Ferrero. The possible reasons for such a situation may be related to the two following factors. Firstly, the European market is four times larger than the UK alone and secondly, there is a big saturation with the moulded bars on the continental market and these are the specialities of Cadbury.

In 1992, Cadbury's total sales exceeded Ł 3 bln. However, the company admits a 1% decline in overall UK chocolate production that year (EIU Retail Business, 1993). Two years later in 1994, an 11% increase volume of confectionery reflected the long term objective achieved by the encouraging the growth of core markets and many acquisitions in Europe. For instance, the acquisition of Bouquet d'Or reinforced Cadbury's position in France, while the Dulciora acquisition established the second position of the company in the Spanish confectionery market. The famous leading Irish brand Time Out has been launched by Cadbury in 1992 and at the moment is being launched in Australia. Since 1980 Cadbury launched also to

five leading brands: Twirl, Wispa, Boost, Strollers and Spira. These examples of innovation and assurance of variety may be the partial explanation of the company's success.

The company's ambitions also aim into the sugar confectionery area. Cadbury has acquired a Spanish wafer biscuit and sugar confectionery company, the Hueso Group, as well as the UK sugar confectionery makers Trebor, Basset and Lion. The company has diversified in the chocolate areas. It entered into a joint venture arrangement with Wall's to produce Dream and with Manor Bakeries to make chocolate cake, since then sold under the Cadbury name.

The presence of Cadbury in the USA is strongly established since 1988 when it was sold out to Hershey. Hershey continues to manufacture Cadbury's chocolate brands under licence. Cadbury is attempting to strengthen its global status through the expansion in Africa, India and the Pacific Rim areas. Here the increase in disposable income is now leading to the growth in popularity of chocolate.

Cadbury's expansion programme is continued throughout Continental Europe. In 1991, a 70% holding in Piasten, the German confectionery business was bought. Piasten was especially important in the strategic planning of Cadbury as it was specialising in so liked chocolate assortment which was exported to Central and Eastern Europe. Developing markets are also important in the long term strategy of Cadbury. Exports to Russia grew strongly in 1994 and production started at a new factory in Poland. In 1995, Cadbury started to manufacture in new chocolate factories built in China and Argentina. Some investment programmes have already started in India and Egypt. Cadbury's overseas operations span 150 countries and are widely but thinly spread. The market leadership is only confined to the UK and certain Commonwealth countries.

The positioning adopted by Cadbury Ltd. in the UK marketplace is strong and may be described as „the number one name in chocolate".

- **MARS CONFECTIONERY**

In 1932, Forrest E. Mars arrived to England from the USA. Renting a factory in Slough Trading Estate he began making Mars Bar by hand which quickly became a popular snack. From the 1960s, Mars Confectionery began expanding in Europe,

with factories in Holland, Austria, France and Germany. In 1991, all the European units were merged into one organisation, known as Snack Foods Europe (SFE). At the moment, SFE employs around 5,000 associates, of whom about half works in Slough.

In 1993, Mars had a second position on the European confectionery market with a 16% market share (Maynes, 1993). Mars Confectionery is part of Mars (UK), which is the UK subsidiary of the US corporation and that is a truly global operation in many food sectors. The British operation is based in Slough, Berkshire (Market Intelligence, 1991).

Mars was one of the first companies which appreciated the potential of the new markets available after the removal of the iron curtain. Today the most rapidly expanding markets of the company are those in Central Europe and Russia.

Although best known for its Mars Bar, the company produces many other leading chocolate confectionery as: Twix, Maltesers, Milky Way, Snickers, Bounty, Topic, Opal Fruits, Revels, M&M's, Tracker, Tunes, Fun Size, Galaxy or Mars Bar Eggs. Mars Confectionery is weak in the boxed sector but it has an overwhelming strength in countlines, the largest chocolate sector with four top products as follow: Mars Bar, Twix, Snickers and Bounty.

In recent years, the company's product development focused on the establishment of different sized products, which had aimed at different market niches. Mars was a pioneer with multipacks therefore, in 1992 it re-launched its biggest brand, Mars Bar, which is now available in a snack-size, a treat-size and a king-size offerings. Its position in the UK market is only just behind Cadbury in total confectionery market and just behind Cadbury and Nestlé Rowntree in the chocolate sector.

- **NESTLÉ ROWNTREE**

In 1993, Nestlé S.A. (Switzerland) was the Europe's leading confectionery manufacturer with a 20% share of market (Maynes, 1993). Since the open European market in 1992 Nestlé has been seeking to purchase a number of pan-European brands for establishing its stronger international position. Between 1987 and 1988, after a public battle with Suchard Nestlé acquired Rowntree. As a result the new

company has the largest sales of any confectionery supplier in the world. This acquisition of Rowntree in 1988, gave Nestlé number one position in Europe while before the company had only the 5th place in the European chocolate market.

In the UK Nestlé Rowntree has 26% of the chocolate market, that makes it to be just a 2% points behind Cadbury. The company sits alongside Nestlé Grocery Food and Food Service Division in the UK and as a true international organisation competes with other world scale operators.

Nestlé Rowntree is strong in countlines such as Kit Kat and particularly strong in the boxed chocolate sector like Quality Street, After Eight and Black Magic and accounts a share of over 30% of this sector. The company is also synonymous with Yorkie block but it does not quite match up the popularity of such brands like Cadbury's Dairy Milk and Fruit & Nut. New products recently introduced are as follow: Bianco, a white chocolate, Secrets and Vice Versas. Nestlé has also a strong brands in bagged products such as Smarties, mints as Polo Mints, as well as in gums and pastilles such as Fruit Pastilles.

In the Western part of Europe, e.g. in Belgium, Nestlé used to produce white chocolate. The four Nestlé's brands are marketed in this country. These are as follow: Galak - white chocolate in four varieties; Crunch - milk chocolate; Nestlé Noir - dark chocolate and as the fourth Disney Family - milk chocolate.

The strategy of the company includes also looking towards the newly opened countries of Central and Eastern Europe. At the beginning of 1992 Nestlé announced it would be acquiring a major manufacturer in Czechoslovakia - Cokoladovny. Soon after, the acquisition was done as a joint venture together with the French biscuit manufacturer, BSN, who took cookie part of Cokoladovny and Nestlé bought the chocolate business.

The other new markets for the exportation by Nestlé are Australia and Latin America. In Malaysia a new factory produces Nestlé's Kit Kat brand. In such developing countries as Malaysia or Indonesia, chocolate is a luxury product, not a staple food. Therefore, according to the strategy statement of Nestlé it is important that chocolate should be more affordable and people will eat it more often.

Because of the fact that the sensory analyses, performed by the author, included the chocolate bars made by Terry's of York company, its presentation is probably reasonable here.

- **TERRY'S OF YORK**

Terry's of York has the fourth position on the British chocolate market, having a 4% share of the total confectionery market. Before the acquisition by United Biscuits in 1982, main lines of Terry's were in the boxed assortments and seasonal confectionery. Soon after, the company was involved with moulded chocolate bars.

In 1992, Terry's of York became part of the Philip Morris / Suchard group. Since then Suchard markets the Toblerone and Milka brands, while Terry's has the All Gold boxed and solid chocolates, Chocolate Orange and other best sellers such as Moonlight assortment and Pyramint that is a fondant filled countline.

Having its share in the fourth force in the UK market Suchard will probably strongly compete with its major rival that is Nestlé.

4.2.3 Strategies of the English chocolate manufacturers

CADBURY

- Specialising in moulded chocolate bars but also produces many countlines,
- Innovative new styles of packaging and new sizes of products,
- Precisely targeted expansion programmes: acquisition and partnerships through Continental Europe, Africa, India, the Pacific Rim and Australia,
- Constant emphasis on investment in the production equipment, consumer advertising and marketing,
- Company's policy statement: „ (Our) methods of diversification...were seen by the companies as the acquisition of <known-how> or the acquisition of a separate company" (Rowlinson, 1995). However, in many, especially developing countries, company starts from scratch, i.e. building a new plant,
- The highest advertising expenditure on chocolate confectionery in 1992 accounted for Ł 28 mln,

- In 1993, Corporate Environment Policy was issued and adopted by the company. This policy aims into the „improved performance in air emission, water, energy and materials conservation, waste water treatment, packaging and soil / ground water protection" (Cadbury Schweppes, 1994),
- Contribution to the communities in which the company operates. Through the Cadbury Schweppes Charitable Foundation the company supports financially and commercially local programmes that target into facilities and management resources. It seems to be worth to mention just a few examples of such support:
  - Contribution of Ł 420,000 to Save the Children Fund,
  - Sponsorship of the 1994 Midlands Woman of the Year which helped to rise Ł 17,600 for the holiday centre for disabled people,
  - Sponsorship of the Partnership Award for Communication Skills at the Universities,
  - Cadbury Ireland contribution to the local unemployment programmes (Cadbury Schweppes, 1994).

MARS

- Overwhelming strength in countlines,
- Multipacks as well as family purchase items strategy,
- Worldwide expansion,
- US style of marketing, in 1992 the expenditure on advertising reached Ł 24 mln.
- Expansion into the hand-held ice cream market, in which the company has now nearly 20% market share,
- Continuous search for new business opportunities and market potential in both developed and developing countries,
- Strong trend towards marketing of branded propositions, as the company does not make own labels,
- Sales through grocery supermarkets, co-ops, petrol stations, off-licences and multiple owned CTNs (Confectioners, Tobacconists, Newsagents),
- Pioneering in new outlets such as: football clubs, video stores, hospitals, chemists, theme parks,
- Sponsorship activity includes: World Cup USA '94, National Football Teams (England, Scotland, North Ireland and Wakes Football Teams), 1995 World Athletics Championships in Gothenburg, Grass Roots (English Schools Football Teams),

- Involvement into the environment protection through reduction of packaging waste and energy savings,

NESTLÉ ROWNTREE

- Specialising in boxed assortment and has one excellent product in each type of products that manufactures: in countlines - Kit Kat; in seasonals - Smarties Eggs; in blocks - Yorkie,
- Global expansion and powerful local distribution networks,
- Extensive advertising accounting for about Ł 24 mln in 1992.

TERRY'S OF YORK

- Specialising in chocolate bars and boxed assortment,
- Development of two major products in bite size category i.e. Smarties and Rolo,
- Product enhancement programmes and acquisition in rather niche sectors such as own-label markets.

4.2.4 Other English chocolate manufacturers

The other chocolate manufacturers who are also important and should be mentioned here are presented below.

First of them, ***Philip Morris /Jacobs Suchard / Côte d'Or*** moved into the UK market with its Milka brand having the aim of establishing himself as the fourth largest chocolate confectionery brand. The company produces the chocolate countlines under the Nussini and Leo labels, which are very similar to those manufactured by the English companies, and chocolate block under the Milka label. These products of high quality are directly competing with the UK market leaders Cadbury's Dairy Milk and Rowntree's Yorkie. Jacobs Suchards' UK products are Lila Pause countlines, that are also not radically different from existing UK countlines (Lynch, 1993).

Another one ***J.W. Thornton*** produces high quality hand-made chocolates. Its best selling brand is Continental, with the sales of over Ł 20 mln in 1989 (Market Intelligence, 1991). The company preferably sells through the Market & Spencer chains of supermarkets.

Lindt, a Swiss-origin company which developed sales through grocery outlets, specialises in chocolate range from Treats to Easter Eggs which are one of the fastest growing products in the UK.

The next, ***George Payne*** is the company owned by the Scottish James Finlay group. It specialises in quality boxes of various assortment. The best known are Just Brazils, Poppets and Pazazz.

Famous Names will be the last company to be mentioned here. The firm as a part of Imperial Foods takes around half of the liquor market with, among others, its special products such as, Malibu, Pina Colada and Black Russian brands.

4.3 LEADING CHOCOLATE MANUFACTURERS IN POLAND

4.3.1 Introduction

The confectionery industry in Poland, was alongside meat processing, one of the most successful sub-sectors during the period of transition from central planned to free-market economy. This is mainly related to the stability of the domestic market in 1990-1991 as well as a good export performance of the confectionery industry (Belka, 1993). Chocolate manufacturers, both national and foreign, operate in a fully competitive environment therefore, confectionery industry is one of those sectors which underwent a dramatic progress in quality.

Production of chocolate in early 1992 was twice as high as in 1988. The possible reason is the better access to imports of cocoa beans under the new system of internal convertibility of the zloty, that „allows the industry to satisfy the nominal level of domestic demand for chocolate" (Belka, 1993). Many of chocolate producing companies were set up on the premises of private firms that existed before the Second World War. Some of them have still old and depreciated machines and equipment. However, the market leaders, such as Wedel or Goplana enjoying higher financial capacities heavily invest in the modernisation.

The domestic market is the main outlet for most of the Polish chocolate manufacturers. Some of them has been selling their products abroad and have some experience in this respect. The former USSR was one of the biggest importer of

Polish confectionery products but the collapse of this market undermined, in many cases, the prospering trade between these countries. At the moment, the situation is changing again and a few Polish chocolate manufacturers export to Russia and other Baltic Republics.

Many of the Polish chocolate factories have already begun a new sort of ownership changes. However, according to some economists „the traditions of labour management and difficult economic conditions of most enterprises are among the factors slowing down ownership changes in Poland" (Belka *et al.*, 1993).

The most popular and willingly bought chocolates in Poland are: Wedel (38%), Milka (20.0%), Goplana (17.6%), Wawel (10.5%), Nestle (7.5%), Ba³tyk (4.0%) as well as Alpina (3.4%), Dove (2.5%), Lindt (1.7%), Kinder Chocolade (1.5%), Fazer (1.4%) and Alpenrahm (1.1%) (Boruc, Cielemêcki, 1995). Other chocolate brands' shares are lower than 1% with Cadbury 0.6%. At the moment, from about 145 producers of sweets in Poland, the most important domestic confectionery manufacturers are Wedel, Goplana, Wawel, Jutrzenka, Olza Cieszyn, Greenvita, Ba³tyk Gdañsk, ZPC San and ZPC Mieszko (Boruc, Cielemêcki, 1995).

Only first three of them are specialising in the production of chocolate. These major companies, with the exception of Wawel are now acquired by the international groups dealing with food industry. The table below shows the major four foreign investors in confectionery sector in Poland.

Tab. 4.1. Four major foreign investors in confectionery industry in Poland

INVESTOR	INVESTMENT OBLIGATIONS ('000 $US)	MAIN POLISH PARTNERS
1. PepsiCo -USA	500,000	Wedel S.A. -Warszawa
2. Kraft-Jacobs Suchard	54,000	Olza S.A. - Cieszyn
3. Nestlé - Switzerland	50,000	Goplana S.A. - Poznañ
4. Fazer -Finland	5,500	Ba³tyk Sp. z o.o. - Gdañsk

So: Business Foundation Book, 1995

4.3.2 Characteristics of the leading Polish manufacturers and brands

- **WEDEL**

„A satisfied consumer makes for the company's best client and the merchants firmest support..." wrote Karol Ernest Wedel, who arrived to Warsaw from Berlin in

1845. Six years later he opened an enterprise manufacturing confectionery and chocolate. His son Emil Wedel moved this manufacturing department into the another street and opened an „Old Style Shop" and a chocolate house that both made a furore that time.

Emil Wedel, as the first in Poland manufacturer of various kinds of hard chocolate, established his own signature which is used by the company till now. It is not only used as a trademark but also as a symbol of top quality and as decoration on i.e. Wafer Cake, famous hand-made speciality of the company. In 1929, Emil Wedel awarded the Grand Prix Award at an All-Polish Exhibition in Poland.

One of the goals of Emil Wedel was to build a tight network of own-shops all over the country and this wish was soon realised. His shops existed in Paris and London and this time the company had its own plane for transportation of goods. Additionally, the company's representative office in New York served the American market. After the Second World War and the nationalisation of the factory the communist authorities did not permit the ex-owner to stay on premises. Therefore, Dr. Jan Wedel, the next relative of the family, had to leave his factory which was soon renamed as „Zak³ady Cukiernicze im. 22 Lipca - d.E. Wedel" („The July 22nd Confectionery factory - formerly E. Wedel")*. Acquisitions and merges are also known in the Polish companies. In 1960, the E. Wedel merged with „Syrena" factory. Eight years later the company merged with a fudge producing plant „Milanówek", which was also previously private-owned business.

At the beginning of 1990 a decision was rendered to privatise the company. The same year E. Wedel acquired the status of a single membership company of the State Treasury. In 1991, an agreement for the purchase of 40% of E. Wedel S.A. shares was signed with the American PepsiCo corporation. Today, PepsiCo has about 70% of Wedel's shares. The strategy of this partnership is to combine the company's tradition with modernisation as well as dynamic development. In 1993, the first stage of Regional Distribution Centres (RDC) system was completed with the foundation of such centres in Warsaw, P³oñsk and Gdañsk.

In 1992, the company merged with Frito-Lay Poland in order to diversify its products. A new fully automated plant was founded in Grodzisk Mazowiecki and soon after a range of salty snacks was introduced to the market. Presently, E. Wedel

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* On the 22nd July of 1944, the Manifest of PKWN (Polish Committee of National Liberation) was published by the communist government. This act covered law on the nationalisation of the private enterprises. During the years the 22nd July was celebrated as the national holiday of the communist ruled country.

possesses four plants: first basic in Warsaw, which is the chocolate production centre, second in Grodzisk Mazowiecki which specialise in salty snacks, third in P³oñsk that produces confectionery bakery and the last one Syrena which is famous from candies.

For years E. Wedel's products were recognised from constantly excellent quality and it cannot be denied that the company enjoys a leading position on Polish confectionery market. The E. Wedel Wafer Cake brand is only one of several selected Polish products which were recently awarded a prestigious prize „Teraz Polska" („Poland Now"). This prize indicates the Polish goods promoting Poland abroad.

The brand name „Wedel" is known to almost every Pole and through the special company's activities such as the agreement on mutual cooperation and use of trademarks, which was signed in 1994 with the Frederic Chopin Society, the company enjoys a huge public warmth and recognition. While marketing Wedel's products to an international audience the company helps to promote Polish culture.

The similar kind of collaboration has been established with the Polish Olympic Committee. This agreement gives Wedel the exclusive rights to use the Olympic Symbol and will undoubtedly help to popularise the firm.

In 1994, E. Wedel donated funds for the purchase of medical equipment for the Warsaw's Grochów Hospital as well as for the Warsaw Medical Academy and the Central Children Hospital. As Cadbury in the UK who contributes to the communities in which it performs, E. Wedel has earned the name of „Corporate Citizen" which means the one who is not only a manufacturer seeking for the profit but also an active participant in the national community.

In October 1995, E. Wedel, being on the way to achieve the ISO 9002 certificate, totally prohibited smoking on the territory of its premises. For convincing

and motivation of its employees to stop smoking, E. Wedel paid them 100 zloty each month through the whole year (¯ycie Warszawy, 1995).

At the moment, the company employs about 3,000 people and its turnover was accounted for $ 110 mln (US) in 1994 (Business Foundation Book, 1995).

- **GOPLANA**

Goplana S.A. was established over 88 years ago in Poznañ. Since that time the company is well known on the Polish confectionery market from its delicious products, especially chocolate bars, candies, boxed assortment and small cakes.

In 1994, after a battle between the English MAN and Swiss Nestlé, it was acquired by Nestlé - Switzerland with 47% shares for Goplana S.A. After the intensive process of investments, Goplana's latest offer is the chocolate and caramel wafer Lion that makes a real furore all over the world. The company supply about 20% of the Polish chocolate market (Boruc, Cielemêcki, 1995).

- **WAWEL**

Wawel S.A. company states about itself as follow: „We have 80 years experience in the production of confectionery reflected in the quality of our products, competitive prices and commercial reliability" (Business Foundation Book, 1995).

The origin of the firm goes back to Adam Piasecki, a famous Cracovian confectioner who is considered to be the „father" of Wawel S.A. company. More then eighty years ago he established a confectionery factory in Cracow and soon after his name was popular among the continuously growing clientele. At the beginning, he created a small firm and employed only 5 people but very quickly tasty products of Piasecki were well known in the whole Poland.

After the Second World War in 1951, a new enterprise was born: „Zak³ady Przemys³u Cukierniczego Wawel„ („Wawel Confectionery Industry") as a result of the merge of Suchard and Pischinger factories with A. Piasecki Company. The firm operated under this name until 1992 when it was privatised and renamed to Wawel

S.A. In fact, the name of the company comes from the hill in Cracow with the historic Royal Castle.

Wawel S.A. exports its chocolate products to more than twenty countries around the world and these include: Russia (71%), Rumania (17.8%), the USA (4.4%), Ukraine (2.4%), Canada, Israel, Austria and Germany. In 1994, all exported goods of Wawel S.A. accounted for 17.5% of total production, at the moment this figure rose up to about 25%. However, the main market of the company is the domestic market.

Wawel's wide range of various sweets includes: solid and filled chocolate bars, filled chocolate batons, chocolate-covered candies, hard and filled candies, cacao, wafer bars and sugar-free sweet products. In 1994, the company received the award „Poland Now" for its filled chocolate assortment: Tik-Taki, Kasztelanki and Malaga. The last category of newly developed sweets that was given a name Light gains a great popularity and acceptance. The Light products contain aspartame - the artificial sweetener which is 200 times more sweet then sucrose therefore, the Light seria of chocolates is cheaper than similar products of foreign producers. The product has recently received some distinctions as the „Gold Medal" on the XI International Fair of Life & Food - Tarnów '95; the award of „The most Interesting Product" of Krakfood '95 Fair and also many letters of acknowledgement and acceptation from hospitals, health concerned institutions and individuals.

With the turnover around $ 71 mln (US) and 1,800 employees, Wawel S.A. is presently in process of preparation to join the Stock Market (Business Foundation Book, 1995). The company invest in the protection of environment through the new engine-room of low dust emission and sound-absorption windows. It also sponsors cultural and sport events, many schools and kindergartens and the Polish Red Cross (PCK).

- **JUTRZENKA**

Jutrzenka comes from Bydgoszcz. For a time of being, the company does not possess any significant investors whose shares would exceed 5%. After privatisation in 1993, Jutrzenka achieved in 1995 increase of its sales up to 38%. However, 50% of its profit is devoted for further investments.

- **OLZA CIESZYN**

Before the privatisation, the company was one of the most modern confectionery factory in Poland. In 1978 the production of famous Prince Polo wafers started here, with the market share of about 20%. In 1993, 80% of company's shares were sold to Jacobs Suchard which obligated itself to invest above $11 mln (US). Today this investment exceeded over $ 25 mln (US) (CASH, 1996). This time Jacobs extended its shares to 99%. Last year a new production of Milka chocolate line was opened in Cieszyn plant which has now around 20% of market share (CASH, 1996).

In 1994, market shares of six leading chocolate brands* in Poland were as follow: Wedel (44.3%), Mars (22.2%), Snickers (14.3%), Milka (3.4%), Wawel (3.0%), and Goplana (2.9%) (Rydel, Kamiñski, 1995). The same year the top national producers of confectionery products revealed the figures presented below.

Tab. 4.2. Top national confectionery producers in Poland in 1994

COMPANY	INCOME (mln z³)	PROFIT NET (mln z³)	EXPORT (%)	EMPLOYMENT
1. Wedel	370,6	53,7	6	3,237
2. Goplana	158,8	4,4	5	2,131
3. Wawel	140,7	10,0	15	2,002
4. Jutrzenka	63,4	7,0	9	0,891

So: CASH, 1996

4.3.3 Strategies of the Polish chocolate manufacturers

WEDEL

- Aims at bringing company's products closer to consumers, through the formation of a unique distribution system with the emphasis on top level of service and display,
- Diversification through the merge with Frito-Lay Poland by which salty snacks (Ruffles, Fritos, Chee-tos, Drakis and Bocabits) were introduced,
- Expansion of product lines by the continuous working on new products, its modification to the size and packaging appeal,

- Investment programme of 1993 brought new chocolate snack bars and in 1994, six new kinds of chocolate bars (Kremowa, Mleczna, Deserowa, Cappucino, Mocca and Gorzka),
- New forming equipment was bought that lets to package chocolate in smaller than 50g tablets,

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***** ”Brand Leadership” is the brand which reputation is leading and that may not be equal with the market share which is measured by the sales (Rydel, Kamiñski, 1995).

- Company’s statement: „Our company has a clear view of the future. Firstly, we aim to maintain our strong position in these areas where we have been established for years, i.e. in such product categories as chocolate, biscuits and selected groups of candies. Secondly, we seek for..an equally important place in a new area - salty snacks” (E.Wedel, 1994).

GOPLANA

- New investments in a logistic department and also in marketing and advertising sector,
- Product development.

WAWEL S.A.

- Product development (only through one year 1994, a range of 17 types of sweets was developed and introduced by the company),
- Introduction of new technologies which allow manufacture of sugar-less seria of products,
- Automation and computerisation in the production processes,
- New forms of organisation and management i.e. more effective consumer service,
- Higher exportation in comparison to other companies.

JUTRZENKA

- Foundation of a new plant for wafers production and plans for a new line for chocolate in 1997,

- Investments in modernisation aimed into the improvement of packaging and quality of products.

OLZA CIESZYN

- Investments in new lines such as Prince Polo,
- New production of chewing gum ‘Hollywood”,
- New line of Milka production.

4.3.4 Other chocolate manufacturers in Poland

The German potentates calculated that the consumption of chocolate products in the East European countries will increase in few years from 246,000 tonnes annually to the half of million approximately (Na Przyk³ad, 1995). Therefore, besides the national companies operating on the Polish confectionery market, the recently established foreign firms, such as English Cadbury, German Bahlsen, Italian Ferrero, French Cacao Barry or the American Mars gain high profits.

However at the moment, the biggest chocolate production line in the country, which produces about 80 tonnes per day, belongs to the Polish company ***Greenvita*** from Poznañ. The company produces about 20,000 tonnes of chocolate annually specialising in chocolate bars and chocolate spreads branded Terravita (Boruc, Cielemêcki, 1995).

The most dynamic Western competitor, ***Cadbury Schweppes***, produces only 13,000 tonnes annually. English manufacturer chose the strategy of not buying any of Polish chocolate firms but to build brand new plant, that is realised in Kobierzyce near Wroc³aw, the region deserted from any chocolate business (Boruc, Cielemêcki, 1995).

It is believed that within a few years Poland will become one of the biggest confectionery producer in Europe as many new investments have already started here. For example, the Italian concern ***Ferrero***, which is the sixth on the world ranking list, is now building a factory in Belsk Du¿y near Radom. The location is strategic point as it is near the international highway E77 (Leszczyñski, 1995). It is

supposed that this will be the biggest investment in Poland till now and the company will employ about 300 people.

The next example, the German concern ***Stollwerck*** build a factory in Jankowice near Poznañ where the company produces Alpen Gold chocolate bars.

French firm ***Cacao Barry*** has a factory in Lublinek near £ódŸ which was built at the end of 1995. This plant is supposed to be the most modern industrial chocolate producing factory in Poland. While employing about 50 people the company produces 18,000 tonnes of by-products annually (Gazeta Wyborcza, 1995). It is not confidential that Cacao Barry will supply Wedel and Olza companies with its industrial chocolate (Dziennik £ódzki, 1995).

Israel firm ***Elite Industries Ltd.*** also invested in the modernisation of confectionery factory Spo³em in Szczecin. Today, this factory under the new name Union Szczecin is one of the most modern factories on the West Coast of Poland (Boruc, Cielemêcki, 1995).

5. QUALITY CONTROL IN CHOCOLATE INDUSTRY

5.1 PRINCIPLES OF QUALITY CONTROL AND QUALITY ASSURANCE

The confectionery industry is quite specific for the development of quality control methods. During the last two decades the production of chocolate is becoming more and more mechanised and quality standards increased step by step. During this time the quality control of raw materials and ingredients has been introduced. Inspection methods of finished products are developed. Wide understanding of the need of quality assurance through the repeatability of all stages in the production process is well established in the mentality of the managers and further implemented gradually.

Quality is defined in many ways. According to the British Standard, Quality is defined as „the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs" (BS 4778: Part 1: 1987). In marketing, quality means „Fitness for Purpose" or „All these properties of a product which are of interest to the producer, manufacturer, distributor, retailer and the consumer" (Davis, 1968). The simplest definition of quality states „a degree of excellence" (Amos, 1968). The following aspects relate to the definition of a total food quality: the nutritional value, health value, organoleptic value, functional value and social value of food.

Quality is one of the major components of competitive advantage. The food processor pursues quality with the aim to satisfy customers at a competitive price. It has already been proved that it can only be achieved in an approach of continued product development and design improvement in a cost effective and efficient way.

The quality standard is usually set by the Sales and Marketing Executive (Minifie, 1980) and is fixed at the most earliest stages of product development. It is also as high as possible but must be compatible with the market, that means it needs to have the right price for the market to which it is intended to be sold. Many problems can occur when the quality is aimed too high and is sold at a price which only appeal to a small number of consumers.

After the quality standard is established the responsibility for manufacturing according to this standard have to be stated. It is highly incorrect to believe that the Quality Control Department is the only responsible for the quality of a product. The process of mentality change among the personnel is continuously increasing and those who work under ISO standard have already introduced this quality oriented behaviour.

Quality control in food industry is enforced by legislation, which helps to safe guard the health of the people against malpractices and to ensure a minimum content of important constituents of the product. However, quality control by legislation has established only a minimum standard. In a competitive market the food manufacturer must not only carry out the control of ingredients and the hygienic conditions but also he needs to control all the operations as to ensure the texture, flavour and appearance that please the customer and do not vary from batch to batch and from day to day. The quality control includes the following: packaging, storage and transport to the point of sale.

The right quality of the product may be achieved in two ways: by the traditional „Quality Control" or by the „Quality Assurance" approach. While the former goes simply to the end product inspection and testing, which is usually done after a long and expensive production process the latter, Quality Assurance, is the constant monitoring of manufacturing processes and the producer has the proof that he took all reasonable precautions to avoid committing the offence, as all the operations are documented and records are kept. Quality Assurance has tremendous advantage over quality control.

Quality Assurance may be carried on three levels. These are:

- Quality programmes such as Hazard Analysis of Critical Control Points (HACCP) system,
- Quality Management System, like ISO 9000 series,
- Total Quality Management, which is part of the institutional organisation.

Only the most advanced and consumer oriented companies implement Total Quality Management as it deals with human factor which is highly difficult aspect of every business. In the simple Quality Control approach the Quality Control staff is cooperating with the production staff and takes a role of a policeman. A Quality Assurance system makes everyone to be responsible for quality and is defined as:

> „All those placed and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality" (BS 4778: Part 1: 1987).

The achievement of the satisfactory quality involves active participation of all the concerned parties within the organisation. It can be even indicated that all people from market research through after-sale service are equally important in the Quality Assurance system. Quality Assurance systems are the most reliable operations which provide documentation necessary for inspections and external audits. It seems to be the only way in which the customer can be assured that product will meet stated requirements before manufacture starts.

In conclusion, it may be said that food product quality, such as chocolate products quality, should be measured by the following factors:

- Product compliance with specifications for the individual type of product,
- Product compliance with national legislation,
- Product compliance with industry standards in terms of such parameters as composition, sensory attributes, food safety and microbiology aspects, shelf life and packaging,
- Price,
- Cost benefits in relative to other raw materials,
- Reliability of technical performance (in case of chocolate ability for keeping its solid state in appropriate temperatures, etc.),
- Product consistency from batch to batch (Minifie, 1980).

Additionally, for a product such as chocolate which is sold mainly through the small private outlets, where the quality of service has a critical influence on the consumers' behaviour, the following factors may be important to be measured:

- Attitude towards customer,
- Courtesy and efficiency of contact,
- Qualification of service staff,
- Creativity and innovation in regard to product presentation,
- Availability of product,
- Product guarantee and serviceability,
- Liability which means legal responsibility for the product with any defects,
- Effectiveness of invoicing system ,
- Time and method of product delivery.

Such factors as legal responsibility of the producer and product guarantees, together with the provision of samples and opportunity to inspect the manufacturing process, are going to be more and more important, especially for the more aware customers of today.

5.2 QUALITY CONTROL IN CHOCOLATE CONFECTIONERY

Four main spheres of operation in the control of chocolate quality are analysed: raw ingredients, process of manufacture, the finished product inspection and the control over the parameters of storage.

5.2.1 Raw materials control

The ingredients used for chocolate production being mostly of natural origin, are subject to natural variations. Therefore, in order to set the formula (the final composition of the product) or to adjust the processing conditions, appropriate provisions are needed.

The essential raw materials required for the manufacture of chocolate products are cocoa beans and sugar. From cocoa beans the cocoa mass and cocoa butter are obtained. Milk is added to milk chocolate as well as many secondary materials such as dried fruit and nuts. The technological aids as lecithin and many different flavourings are also used in chocolate production.

5.2.1.1 Cocoa beans

The quality of cocoa beans depends upon many factors such as particular variety of the beans, care taken in its cultivation, fermentation, drying and storage. Being the basis of all chocolate products, cocoa beans are used in chocolate manufacture as „bulk" beans and „fine" beans. The usual procedure adopted for the evaluation of „bulk" beans consists of cutting the beans and noting the internal appearance. „Bulk" (or „Ordinary") grade constitute over 93% of the world's supply (Minifie, 1980), while the „Fine" grade cocoas are purchased by certain manufacturers to make special high quality dark chocolates and are selected for small sample lots and tasting tests are carried out on them.

Since 1975, the International Cocoa Standards have been established in order to fulfil the agreements between producers and consumers. These works are now coordinated by the Food and Agriculture Organisation. The definition of cocoa of „Merchantable Quality" was developed and some of its aspects cover the requirements relating to the uniform size of cocoa beans, freedom from living insects or any foreign matter, freedom from abnormal odours (like those coming from smoky

beans), and also from any evidence of adulterations. Grade standards developed by Codex Alimentarius (Codex Stan 141-1983) differentiate the following grades:

Tab.5.1. Grade standards developed for cocoa beans evaluation

	MAXIMUM % BY COUNT		
GRADE	**MOULDY**	**SLATY**	**INSECT DAMAGED, GERMINATED, FLAT**
Grade I	3	3	3
Grade II	4	8	6

So: Minifie, 1980

The number of defective beans is determined by the „Cut Test", which consists of longitudinal cut and examination of both halves, as to ascertain whether they are correctly fermented or contain any unacceptable substance. This test requires examining the colour of cut surface which may be taken as an indicator of the degree of fermentation. Texture of the cocoa beans surface is of the equal importance. Poorly fermented beans have a waxy cut surface while well fermented beans exhibit a broken appearance. Full details of this test are described in a booklet issued by the Cocoa, Chocolate & Confectionery Alliance and also in the International Standard (ISO 1114: 1977).

In general, beans should be clean, plump, well fermented and with the specific requirements, which cover the eight following requests:

1. The average weight of around 100 beans should be not less than 1 gram, they should be uniform in size (if not roasting problems appear),
2. The shell content should be less then 12% by weight of the bean (economically important factor),
3. The fat content of the nib should be not less then 55% (calculated on a dry basis),
4. The beans should be free from foreign matter,
5. The beans should be free from mould (that gives musty taste and probability of presence of mycotoxins),
6. Damaged, germinated, flat, shrivelled or immature beans should constitute a very low proportion of the sample (as they reduce the yield of nib),
7. The bean must be free from taint e.g. foreign flavours such as smokiness (impossible to remove from chocolate) and hamminess (from bad fermentation), and any contaminants (like insecticides) and odours coming from some cargoes on boats,
8. Unfermented or slightly fermented beans with slaty or fully purple coloured nibs should be absent (as they result in extremely bitter and astringent flavour of end product) (Minifie, 1980).

The research about the content of defective cocoa beans was undertaken and shown that the mostly undesired are mouldy beans, because of the higher free fatty acids content (Kattenberg, 1981).

Tab. 5.2. Analysis of cocoa butter extracted from defective cocoa beans

DEFECTS	MOULDY	INSECT DAMAGED	VIOLET	SLATY
free fatty acids	7.2	2.9	0.7	0.5
di-glycerides	0.7	0.4	0.3	0.4
% solids (DSC)	79	69	66	70

So: Kattenberg, 1981

All goods used for processing at the chocolate factory should be of consistent quality, in the proper packaging and free from foreign materials. The acceptance or rejection of raw materials is made after the visual inspection of the consignment as a whole and after performing some analytical tests to decide whether the material meets the agreed specifications or not. It must be underlined that sampling is the most important part of raw material inspection and an incorrect sample, which is not representative of the bulk, will change all subsequent analyses and bring some economical disadvantages.

Knowledge of the product, its origin, susceptibility to variations and the effect of them on the final product may significantly reduce sampling and analysis. However, if prior knowledge of the consignment (e.g. batch number, supplier's analysis) is not available the „random sampling" method must be performed. This consists of numbering each package or group of packages and then referring to tables of random numbers which appear in many statistical publications.

The routine analyses of cocoa normally include the microscopic examination and determination of moisture content, ash content, alkalinity of ash, and also content of fat, crude fibre, Arsenic, Copper and Lead. These may be done by the High Performance Liquid Chromatography or Gas Chromatography. By means of HPLC, the pyrazines content can also be established, and this corresponds with aroma and degree of roasting of cocoa beans. Other, sometimes necessary, determinations are these of soluble ash, starch, nitrogen, theobromine, caffeine and the cold water extract (Kirk, Sawyer, 1991).

Summarising, the true quality of cocoa beans is determined by the „Cut Test" and the flavour assessment of chocolate made from the beans (Mohr, 1977).

5.2.1.2 Cocoa butter

Cocoa butter is pressed out from the cocoa nibs and constituting 52-56% of the kernel or nib (Schoen, 1951, a) it influences the conditions of manufacture. Being a mixture of esters of glycerine and higher fatty acids (largely oleic, palmitic and stearic) it must fulfil high requirements of taste and equally important crystallisation properties, which are very important in the high quality chocolate.

Another important characteristics of cocoa butter is that it is not easily becoming rancid. Under satisfactory conditions of storage, cocoa butter keeps excellent properties. However, prolonged exposure to light causes development of a rancid taste and smell (Lindley, 1968). Therefore, most of cocoa butter manufacturers use the alkalisation process of the cocoa, which is treatment with soft alkali, to improve taste and colour of the powder. Additionally, deodorization of cocoa butter is carried out, but both treatments are not common for all chocolate manufacturers (Kattenberg, 1981).

A great number of investigations have been made on the crystallisation of cocoa butter. It was confirmed that the complexity of this crystallisation is due to the phenomenon showing that tri-glycerides can crystallise in many different forms which depend on tri-glyceride composition and this is tightly related to the species of Theobroma cacao, the country of its origin and even the plantation and method of cultivation. During tempering process the cocoa butter may recrystalise from the unstable crystals into the stable β crystals. The most unstable are the α and γ crystals.

Apart from the modification of the crystal structure of cocoa butter, there are other changes due to the influences of the processing environment. They may include „..hydrolisation with a subsequent increase of (ffa) free fatty acids and partial glycerides, oxidation accompanied with an increase in polar oxidised glycerides and subsequent decrease of oxidative stability" (Kattenberg, 1981).

The mentioned factors such as oxidation or hydrolisation have a negative effect on the physical properties of cocoa butter however, in some extend this may be reduced by alkalisation and deodorization processes. During alkalisation the free

fatty acids content is lowered but, di-glyceride content increases (Kattenberg, 1981). The deodorization process influences free fatty acids content significantly, which decreases. During this process there are no signs either for hydrolysis or for rearrangement with the tri-glyceride molecules. It is worth to notice that this tri-glyceride composition together with the low content of polar components are the basis of the uniqueness of the cocoa butter (Kattenberg, 1981).

The basic tests carried out on the cocoa butter include: flavour and colour measurement, melting point characteristics and tests for the presence of adulterant fats such as hardened palm kernel oil or hardened coconut oil (Lindley, 1968). Adulteration with Borneo tallow (Illipe butters) is difficult to detect but is well known to the manufacturers of chocolate (Schoen, 1951, a). The following tests, for the control of the state of freshness, are also performed: refractive index, iodine value, saponification value, Reichert-Meissl value, Polensky value and acidity (Lindley, 1968). Additionally, the residual amounts of pesticides in cocoa butter are sometimes checked.

More recent standards do not prescribe the rules to follow for the evaluation of the cocoa butter quality, therefore, it depends totally upon the manufacturer how to test fat in chocolate. Callebaut, for instance, using the HPLC for majority of substances' determination says that „we can even tell from which supplier the mixture of fats comes from". The independent Central Laboratory of the Ministry of Economic Affairs in Brussels, which deals with the quality control within the confectionery industry, applies the Gas Chromatography for the cocoa butter evaluation.

5.2.1.3 Sugar

Sugar, being practically (99,9%) of a pure chemical substance of saccharose, is subject of the Sugar Market Regulations, within the EU-15. These EU-market regulations indicate also the standards for the individual gradations (Krauss, 1972). Chocolate manufacturers buy various types of sugar according to the desired characteristics such as colour, colour in solution and ash.

Therefore, if the supplier of sugar is known to the manufacturer and the specifications are attached to each consignment of the raw material, it seems to be senseless to do the detailed analysis of sugar. A superficial inspection of bags for

damage or contamination should be often performed. Additionally, a single representative sample should be taken from which a syrup should be made for the determination of colour and degree of saccharose inversion.

While being stored in silo, the limit for the allowed percentage of moisture and sugar dust need to be established. If this demand is not fulfilled the sugar granulation may change and this will undoubtedly have an influence on the sensory characteristics of the final product.

5.2.1.4 Milkpowder

Milkfat covers a significant part of milk chocolate. It is one of the few fats which are compatible with cocoa butter, but only up to about 30% of the total fat (Jordan, 1986). At this level chocolate becomes too soft for practical use with exception of very cold circumstances. The American standard for the ratio of non-fat solids to milkfat states that this ratio must not exceed 2.23:1 (FDA, 1980) and minimum milkfat content in regular milk chocolate is around 3.66%. In the European Union law the total milkfat content should be not less than 3.5%. For the rheological properties of chocolate it is important to have an adequate fat content of the manufactured product while using milkpowder.

One of the most important factors that must be monitored carefully, in case of milkpowder used for chocolate production, is its microbiological quality. The absence of Coliforms and Salmonellae has to be assured. Although the chocolate is considered the medium not suitable for the growth of bacteria the operations in chocolate processing are not sufficient for killing any potential microbes. Also residual insecticides in milkpowder should be checked.

Considering sensory attributes of milkpowder, it can be said that the use of milkfat in chocolate is of great significance. Taste tests which relate to the freshness and flavour should be carried out on milkpowder.

5.2.1.5 Nuts, spices, technical aids and packaging

Apart from the above mentioned basic ingredients in chocolate manufacture, care must be taken in other ingredients preparations such as nuts, spices, technical aids like lecithin and also packaging materials. It is important to note that especially spices and nuts need microbiological testing and examination for extraneous „filth”.

As aflatoxins of fungus Aspergillus niger were found in many ground nuts, all mouldy nuts must be carefully inspected by cutting them and looking for infestation or discoloration. Tests for rancidity and a size count should also be performed.

The European Union law on additives in cocoa mass and cocoa powder allows the following substances: E 322 - lecithin; E 450 (a) - disodium diphosphate; E 450 (c) - sodium polyphosphates; E 500 - sodium hydrogen carbonate; E 501 (a) - potassium carbonate; E 503 (b) - ammonium hydrogen carbonate for use in chocolate production (Rutkowski *et al.*, 1993).

5.2.2 Manufacturing process control

The control exercised during manufacture of chocolate products varies according to the scale of the techniques used in the operation. It basically requires knowledge of the likely variations of the properties of raw materials. Control procedure needs clear specifications for processing conditions and established product characteristics at all stages of manufacture and during storage period, known as „shelf-life". It simply consists of controlling of recipes and process parameters with regard to working instructions.

One of the most significant factors in process control is speed of carrying out tests, speed in repeating results and speed in taking corrective action. In this case the graphical recording of results is of great importance as they visualise necessary adjustments that must be rapidly undertaken. The methods of the product and ingredients testing throughout the manufacture process are fundamental and it is considered that traditional laboratory control methods should be performed together with the automatic checks.

Analytical determination of the ingredients should be made at frequent intervals and carefully recorded. Additionally, the need for objective tests of trained taste panels is evident in chocolate industry.

Now different stages of chocolate manufacture will be described in detail with the aim of establishing all possible influences on quality changes.

5.2.2.1 Quality Control Points in chocolate manufacture

The following table describes all steps in chocolate manufacture together with results and some possible parameters which seem to have critical influence on the

correctness of the process course. It was prepared by the American writer and presents physical aspects to produce chocolate.

Tab. 5.3. Main results of each process step of chocolate manufacture and Quality Control Points established for these steps

PROCESS STEP	MAIN RESULTS	QUALITY CONTROL POINTS
1. ROASTING	**1.** Development of the characteristic chocolate aroma	1. **Temperature** Low roast temperatures preferred for chocolate products (95-110^{0}C) or normal roast (110-120^{0}C). Charred portions that give smoky flavour must be eliminated
	2. Evaporation of excess moisture	2. **Charge of roast** 45-135 kg preferred and length of the roast should be based on the type of bean and the weight to be processed
	3. Heat changes resulting in a more palatable product (tannins & bitter astringent substances present)	3. **Time of roasting** The bigger the amount of beans the longer the roasting period
	4. Volatilisation of unpleasant volatile compounds like acetic acid and its esters	4. **Speed of cooling after roasting** If not rapidly cooled over-roasting effects may occur
	5. Drying out the shell, so it becomes brittle and can be easily removed from the nib	5. **Method of roasting** It is significant factor as this step is one of the most important
	6. Killing of any cacao moth ova and larvae that may be present	
2. HUSKING & WINNOWING	**1.** Production of the nibs with the allowable shell content of about 12%.	1. **Completeness of the shell removal** Shell is difficult to digest, has no food value, cannot be easily ground to a fine mass and may impart some off-flavours, therefore, its removal influences the quality of the finished product

Tab.5.3. continued'

		2. **Speed of cracking and dehusking** It should be done as soon as cooling is completed in order to maintain the aroma at its peak
3. NIB BLENDING	**1.** Standardisation of colour, flavour, appearance and eating qualities	1. **Composition** Composition should be established according to the final designation, (blends for nuts coating chocolate differ from cream centre coating)
	2. Obtaining a blend that is unique in flavour and difficult to imitate	2. **Balancing of aroma and sweetness** This is empirical balancing of strength, astringency and bitterness
4. MILLING	**1.** Achieving fine grinding is necessary if cocoa powder is to be made from liquor, since it is the only grinding it will receive. Achieving the required grinding level results in the better cocoa butter yield and better cocoa powder suspension power	1. **Rate of feed** It must be determined and controlled closely due to a great deal of heat that may be developed in the hammer mills
5. MELANGEURING (today known as mixing)	**1.** Helps to complete better blending of various ingredients and prepares the mass for the final grinding	1. **Time and speed** Time and speed of mixing various ingredients vary
		2. **Proper proportions of ingredients** Melangeuring is used for special effects on special products: - when part of the milk solids is treated with a starter to develop a better flavour, or - when milk solids are influenced by some enzymes
6. REFINING	**1.** Obtaining the desired smoothness in chocolate, by disintegration of particles to colloidal size	1. **Speed and spacing of rollers** Speed of rollers should be different. Spacing of rollers must be kept constant to ensure even pressure between them

	in order to get the full flavour	

Tab.5.3. continued”

	2. Finer grinding is an imperative in order to obtain the sensation of smoothness while using cocoa butter substitutes and stabilisers such as lecithin **3.** Reduction of chocolate from fineness of about 0.1mm (the fineness of powdered sugar) to fineness of about 0.01 to 0.02 mm	
7. CONCHING	**1.** Obtaining a product with greatly increased flavour, smoothness and viscosity stability in order to get high quality product	1. **Quantity of chocolate in conche** Best results are obtained when the conche is not too full
	2. Reduced moisture and a considerable quantity of volatile acids corresponds with decrease in the residual harshness and bitterness	2. **Size of conche** Too large conches are not advised
	3. Stabilisation of the chocolate to the viscosity changes by coating every particle of sugar with a thin film of cocoa butter	3. **Temperature** Must be almost near or below the „inversion temperature” of chocolate, this varies from about 57^0C for milk chocolate to 71^0C for dark sweets. The inversion temperature is raised for coatings containing lecithin. Higher temperatures are used where carmelisation is wanted, going over 93^0C for some dark sweets.
	4. Increase in the smooth taste of the material by rounding off the sharp edges of the sugar crystals	4. **Moisture removal** Moisture should be reduced to approximately 50%; it has impact on the „sugar bloom” prevention in the future.

Tab.5.3. continued'''

	5. Development of an additional flavour by the oxidation of the cocoa tannins and the interactions of the various ingredients, while sugar is slightly decomposed and caramelised **6.** Reduction in the tendency for „fat bloom" by the oxidation of a small quantity of cocoa butter as well as by the even distribution of the ingredients	
8 TEMPERING	**1.** Achievement of a fairly stable system (stable fat crystals) by proper melting and cooling processes	1. **Speed** Speed of cooling should not be too slow or too rapid, because if the product is cooled too slowly large crystals may develop, if too rapidly an unstable, supercooled liquid cocoa butter may be created. This can result in fat bloom because the liberated part of heat of crystallisation can melt the low melting fractions of the fat and redistribute them 2. **Time and temperature** Final hardening of chocolate must be watched carefully as the high cocoa butter content influence the poor heat conductivity of chocolate. The chocolate shall be stirred at 49-54^{0}C and then cooled to 30-32^{0}C depending on a type of product
9. MOULDING	**1.** Obtaining product of the desired colour, flavour, snap or hardness, reduced tendency to bloom	1. **Temperature and time** Good manufacturing conditions are suggested as follow: counter current cold air draft in the cooling tunnel and hardening at a temperature of 15-17^{0}C for 45-50 minutes

Tab.5.3. continued””

		2. **Quantity of the butter hardened** Liquefaction and hardening of all the fat must be assured during moulding. If not, unequal distribution of cocoa butter fractions takes place and tendency to bloom increases
10. ENROBING	**1.** Obtaining filled chocolate products with centre covered by the couverture chocolate. The imitation coatings may also be used and these are mixtures of sugar, cocoa and substitute fats. Used for the medical purposes mainly.	1. **Properties of couverture chocolate** It must be properly tempered and cooled in order to obtain its best covering qualities. This kind of chocolate should blend with the centre and each type of covering chocolate is usually associated with different type of centre.
11. STORAGE	**1.** By creation of such external conditions which prevent unwanted changes in chocolate product, the following attributes may be achieved: -sugar particles will stay undissolved and this will prevent sugar bloom, -cocoa butter will not melt, which influences the fat bloom reduction	1. **Humidity** In the conditions of high degree of humidity moisture condenses on the surface of chocolate and can dissolve some of the sugar in the product. As the later evaporation of water exists, the sugar crystals appear as a grey excrescence known as sugar bloom 2. **Temperature** If the storage room is too warm the cocoa butter in the mass melts and expands as the less dense fat rises to the surface of the chocolate and during the cooling process is solidified here in the form of greyish-white film called fat bloom.

So: Schoen, 1951, b

5.2.2.2 In-line process control

The principle of „in-line" process control is based on the automatic measurement of the specific, critical points i.e. physical or chemical characteristics such as temperature, viscosity, colour, acidity or thickness of the manufactured product.

The system, usually adopted in the batch production of chocolate, implements continuous recording instruments, which feed back signals to operating valves adjusting flows of liquids or steam pressure. In this way a quick corrective action on any defects occurring in the final product may be achieved. The establishment of Critical Points helps to introduce appropriate methods of control while focusing on these points. Certain instruments may be implemented in this system in chocolate industry and a general summary of the most important equipment is given below.

Tab. 5.4. Instruments applied as the „in-line" devices in chocolate manufacturing and possible applications

IN-LINE INSTRUMENTATION	MEASUREMENT
1. **Micrometer, Coulter counter, instruments based on the scattering of laser light**	-Chocolate size particles
2. **Viscometers**	
- Redwood Instruments	-Viscosity of enrobed chocolates
- Falling Ball Viscometer	-Consistency of very thick chocolates used for moulding, piping and drops
- Rotational Viscometers	-Complete coverage of viscosity in fluid and thick chocolates
3. **Thermometers**	
- Mercury in Glass Thermometers	-Temperature measurement during tempering and cooling
- Radio Telemetric Instruments	-Temperature inside tunnels, coolers etc., or on moving belts in enclosed spaces
- Infra Red Thermometers	-Temperature measurement without contact with the product (particularly valuable for very viscous products)
4. **Hygrometers**	
- Hair hygrometer or Wet & Dry Bulb Hygrometer	-Relative humidity conditions in factory departments
- Assmann Psychrometer	-Regarded now as a standard reference hygrometer
5. **Nuclear Magnetic Resonance (NMR)**	-Fat content in chocolate -Solid/ liquid phase ratio in cocoa butter
6. **Near Infra Red (NIR) spectroscopy**	-Moisture assessment
7. **pH Electrodes**	-Acidity assessment

8. **Balances**	-Weight checks
9. **Metal detectors**	-Foreign matter checks

So: Minifie, 1980

If the in-line control instrumentation develops it will be highly possible to reduce the necessity of inspections and thus the rejection of the finished chocolate products, which do not comply with the standard.

5.2.3 Finished product examination

The routine examination of chocolate products includes physico-chemical examination and organoleptic assessment. Microbiological tests are also performed by many companies.

The Official Control of Foodstuffs in the UK revealed that the total number of unsatisfactory samples, within the „Cakes and Confectionery" category, was around 850 out of which 54 led to legal proceedings (i.e. prosecutions). This makes 6% of total cases. The comparison of these data to the highly bacteriological „risky" product such as liquid milk - 3339 of total unsatisfactory samples and 67 of which went to the court of justice (2% of total cases) - changes the traditional approach of this problem (The Official Control of Foodstuffs, 1992).

However, because of a very low moisture content of chocolate products, which inhibits the bacteria growth, it is believed that such bacteriological problems are not likely to arise.

5.2.3.1 Physical, chemical and microbiological examination

In respect of the European Union legislation tests carried out on the finished chocolate product may cover the following measurements:

Tab. 5.5. The examined parameters in the finished chocolate products together with the possible methods of their evaluation

PARAMETERS	ASSESSMENT
• Moisture content	Drying method, Carl-Fisher Titration
• Cocoa butter content	Chromatography, continuous extraction, dilatometry, pulsed NMR
• Particle size determination	Projection microscope, Coulter counter, Laser light scattering methods
• Sugar analysis	Titrimetric procedure
• Cocoa beans shell content	Weight method
• Viscosity	Viscometry

• Nitrogen content	Kjeldahl method
• Trace metals (e.g. As, Pb, Cu)	Infra-red spectroscopy, Atomic Absorption, Emission spectroscopy
• Adulterations	Electrophoresis, immunological methods
Tab.5.5 continued'	
• Some special attributes of the particular product (e.g. rum or nuts content)	Weight method
• Lecithin	HPLC
• Shelf-life	Organoleptic assessment
• Volatile components	Liquid chromatography, UV spectroscopy
• Bacteria content	Lumac method, Bactomac, Rapid detection by DNA hybridisation (for Salmonellae spp)
• Shininess of chocolate	Pulfrich photometry

So: Lindley, 1968; Krauss, 1972; McFarlane, 1994

Aspects such as taste, weight and appearance are also of great importance. Taste is assessed by sensory panels who should pick up any changes from standard. Weight should be checked regularly for two purposes: over-weight products reduce profits of the manufacturer and under-weight products are considered as a legal offence. Therefore, deviations in weight need to be watched carefully, recorded on control charts and any shifts occurring must be corrected within lower and upper limits.

Changes in appearance may be checked, to some extend, during processing and this consists of visual checks or of the specially developed measurements of the product's shelf-life. Such measurements, carried out at different degrees of temperature and consistency in the taste tests, can relate to the 10 point quality scale where each number of score indicates freshness or spoilage of a single product (Krauss, 1972).

Another important aspect of quality control in the finished chocolate product is microbiological examination. It should be checked that no spoilage organisms exist in the product. These microbiological tests must not only be carried out on the finished product but it is necessary to observe good standards of personal and plant hygiene as many pathogenic organisms are usually introduced by handling during processing.

The agreements on the types and level of potential spoilage acceptable in raw materials must be established with suppliers. The type of packaging that should be

used during transportation to the point of sale and then in which the product is sold, should also be considered.

5.2.4 Defects in stored chocolate products

While deciding to store the chocolate production, the manufacturer should take into account possible factors that influence the finished goods negatively. Chocolate products should be kept under controlled conditions. The most important of them are temperature and relative humidity.

Heat damage is a defect observed in a form of white fat bloom on the chocolate surface. In spite of the fact that it does not present any harmful effect, heat damage defect is the origin of the highest number of consumer complaints. Therefore, any unsatisfactory handling such as leaving the chocolate in the hot sun while transporting, or placing it by a warm source must be avoided. Controlled ventilation of bulk stores is a crucial factor too.

On the other hand, moisture damage due to the high relative humidity may cause formation of dissolved sugar which appears as sugar bloom on the surface of chocolate products. Infestation of cocoa products is the next possible danger. Because of this threat store rotations must be performed together with scrupulous cleaning, removal of all dust in the storage rooms and checks for the presence of rodents.

5.3 GOOD MANUFACTURING PRACTICES AND HAZARD ANALYSIS OF CRITICAL CONTROL POINTS (HACCP) SYSTEM

Codex Alimentarius established the General Codes of Practice covering general principles of food hygiene in the factory environment. The main purposes of such codes are: firstly - protection of the consumers health, secondly - assurance of fair practices in food trade and thirdly - enhancement of coordination between the governmental and non-governmental organisations.

5.3.1 Good Manufacturing Practices in chocolate industry

The IOCCC Code of GMP (1991) describes a specific Good Manufacturing Practices for Cocoa, Chocolate and Confectionery Industry. This document and the

IOCCC Code of Hygiene Practice (1991) based on HACCP system for prevention of Salmonellae provides guidelines and indicates ways of guarantee of the wholesomeness of confectionery products.

The following aspects are covered here: building requirements; food room requirements; equipment requirements; food waste and rework requirements; supply and use of water, steam, and air; sanitary operations, personnel and production aspects. The document defines Critical Control Points.

Generally, it should be noted that in chocolate production all of the above factors are important, but the most essential are: raw materials assessment (as cocoa beans may introduce Salmonellae), control of personal hygiene (Staphylococci spread out basically through human hands) and environment control.

Strict hygiene rules must be obeyed and wide awareness of the risk of cross-contamination should be sustained among the personnel. As the „Chocolate production is considered to be a dry operation and water should only be used if wet cleaning is absolutely required" (The IOCCC Code of GMP, 1991) the dry cleaning by sanitation with alcohol-based disinfection or a strong hypochloride solution can be of potential dangers and care should be taken in usage and storage of these chemicals.

5.3.2 Hazard Analysis of Critical Control Points (HACCP) system in chocolate industry

HACCP system can be used as a tool for the assurance of microbiological product safety together with the Code of Good Hygiene Practices.

The concept of this system consists in defining the hazards which may exist, determination of Critical Control Points (CCPs), establishment of critical limits which must be met at each CCP, establishment of procedures to monitor CCPs, establishment of the corrective action to be taken in case of any deviations, establishment of an effective record keeping system and finally establishment of procedures to verify HACCP system. ***Hazard*** is defined here as:

> „unacceptable contamination, growth and/or survival of organism of concern to safety",

while the ***risk*** has a following definition:

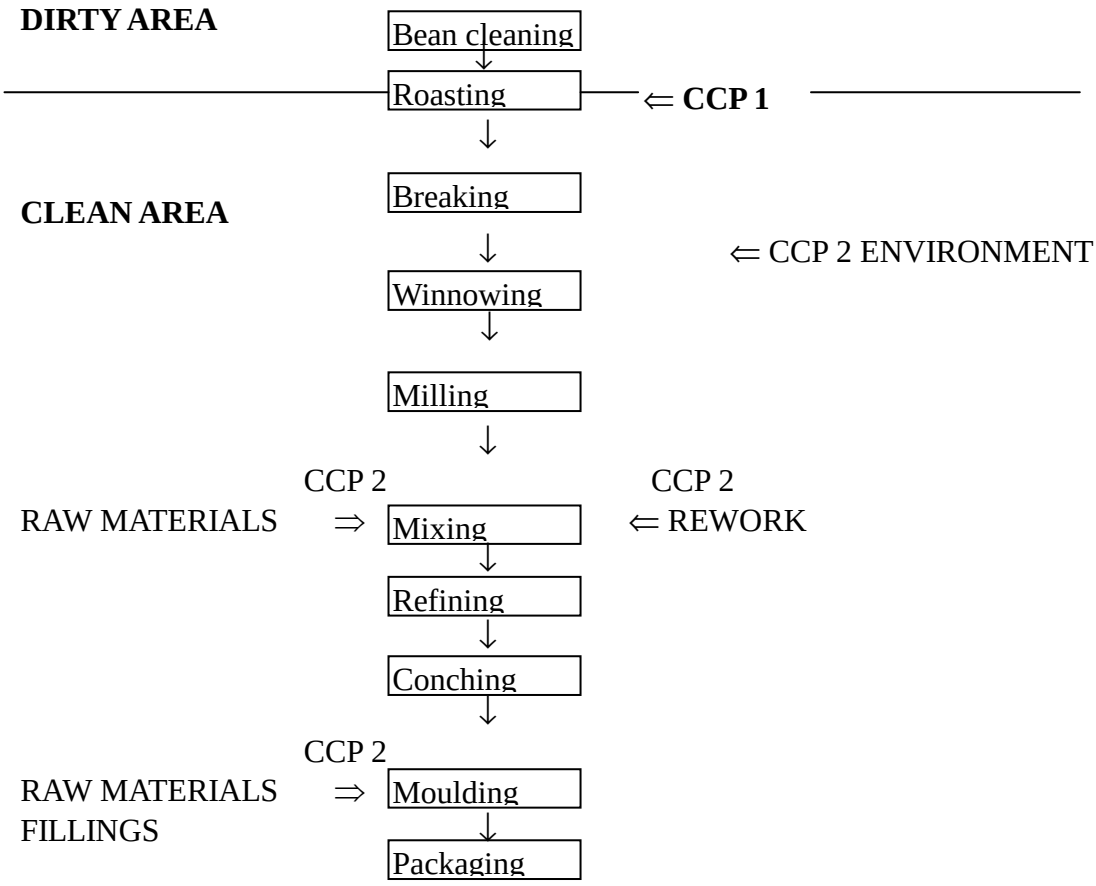
> „elimination of probability of a hazard to occur" (The IOCCC Code of Hygiene Practice, 1991).

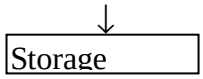
Focusing upon this system, the producer can, in a quick and reliable way, undertake a corrective action in case of any non-compliance with standards defined.

The risk of contamination with Salmonellae, due to its presence in cocoa beans and to the external contamination is high. It is confirmed that only roasting, if properly done, may kill Salmonellae. Therefore, this step is considered to be the Critical Control Point 1 (CCP1), which means that the existing risk may be overcome here by thermal treatment. It is imperative to use adequately high temperature during the roasting process. The next CCPs are CCPs 2 and relate to the steps where the possible risk may only be avoided but never totally eliminated.

The excellent HACCP review of chocolate manufacture is given by Mazigh (1994). This review describes risk of Salmonellae and other factors of contamination during the whole production process. It also shows CCPs and the possible risk management and control practices. Here only a short flow diagram of chocolate production with the indication of CCPs is presented.

Fig. 5.1. Critical Control Points in the production of chocolate - flow diagram





So: The IOCCC Code of Hygiene Practice, 1991

It should be kept in mind that rework must be processed in a separate area. Environment and other raw materials such as fillings and additional ingredients should be checked for any aflatoxins and mould presence. Personal hygiene of employees, especially those who are in direct contact with the production is very important. In the ISO 9000 series of standards, all workers in the manufacturing rooms must wear gloves to reduce the risk of cross-contamination with Staphylococci. Movement from a dirty area to clean ones should be controlled by a simple system of identification of all operations through colour-coding of bins, clothing and shoes.

All the bacteria which are harmful to man, like pathogenic serotypes of Escherichia Coli, coagulase positive Staphylococci, Listeria monocytogenes or Salmonellae must be „absent at levels equivalent to the normal daily intake of chocolate" (Mazigh, 1994).

5.4 COMPARISON OF QUALITY CONTROL SYSTEMS IN CHOCOLATE INDUSTRY IN BELGIUM AND POLAND

The process of quality control in chocolate industry differs in each factory, no matter it is situated in Belgium nor in Poland. All of food manufacturing factories must comply with the foodlaw on safe and hygienic production, but as the process of food law is in continuous development they do not use the same methods of quality control assessment in chocolate products.

Some standards called in Poland „norms" are obligatory, especially those related to the health of food. There is a clear differentiation between „subject norms" and „executive norms". While the former cover the terminology or classification of appropriate products, the latter group of standards is related to the quality assessments through the sampling procedures, microbiological examination, determination of chocolate constituents and their characteristics such as colour, moisture or ash content. Although national standards exist for chocolate evaluation,

each company may use a specific method. However, there are reference methods, which are used to confirm the first result.

The Belgian situation is quite similar in this aspect. According to the Senior Manager of Central Laboratory of the Ministry of Economic Affairs the preparation to use official methods have already started in many Belgian laboratories and is expected to be in practise in a few years time. In the meantime, the laboratories of many companies established their own methods.

In 1990 Belgian leader of chocolate industry - *Callebaut* - received the ISO 9002 certificate as a first in Europe. As this certificate is given only for four years, the company got the second one in 1994. In Callebaut, the Quality Assurance Department is directly under the General Manager and is cooperating with Microbiology Department, Taste Panel, Research & Development Department, and Quality Control Department. The company do not implement any in-line devices. This information comes from the interview with the Environmental & Quality Manager on Wieze site of the company (1996).

The second biggest company in Belgium - *Kraft Suchard Jacobs / Côte d'Or* - received the ISO 9002 certificate in 1991 and then in 1994. Additionally, in 1992 Côte d'Or received an Award for the introduction of the Total Quality Assurance Programme. Quality Assurance Department reports directly to Director of International Manufacturing Centre. In-line devices noted are: metal detectors, checkweighters, nut shell rejector based on the laser light assessment of colour and texture, glass detector for nuts based on density determination, and particle size detector SEDA. It is obvious that one of the company's strategy is the investment in equipment with the aim to save labour and also to improve quality.

The characteristics of the Polish firms differ in many aspects. In 1996 a leader of chocolate confectionery in Poland - *E. Wedel S.A.* - obtained the ISO 9002 certificate, as the first Polish confectionery company. The quality policy of the firm is as follows:

> „ We claim the activity and involvement in the achievement of systematic and appropriate increase of quality of our products - the responsibility for quality on all levels of the organisation as a

response for a steady improvement of our employees' skills - full satisfaction of all the expectations and needs of our clients".

The company organised the Sensory Analysis Department, introduced regular tests for consumer preferences (PFI Challenge programme) and also introduced Gold Standard for chips and basic sweets (E. Wedel, 1994). The following parameters regarding to the quality of chocolate products are assessed by E. Wedel, through the in-line devices: particle fineness, viscosity, fat and moisture content.

Making comparison to Belgium experience, Wedel seems to be very well prepared for the ISO certificate. The work instructions are easily available for all employees in suitable places, rework material is well indicated, personal hygiene is considered to be high (all workers on the production lines wear gloves), cards of control are developed and distributed in all measurement points. The general view is that of an extremely clean and well organised factory. However, in the autumn of 1995, the Quality Assurance Department did not directly report to the General Director of the company but to the Department of Research & Development. In this aspect the company differs from the approach of the West European manufacturers.

Another Polish company - *Wawel. S.A.* - states that „keeping traditional, excellent quality of our products has become our greatest ambition". At the moment, the company is in the process of preparation to the ISO 9001 certificate. According to the Authorised Agent for the Introduction and Maintenance of Quality Assurance system, which relate to the ISO 9001, the decision about the coming forward with the petition for this certificate will probably take place in September 1996. Quality Control Department together with the Authorised Agent report to the Production Director. However, it is worth to note that Wawel S.A. was a first company in the confectionery sector in Poland, which started the Microbiological Laboratory in 1977.

Callebaut may be an excellent example of a company with a highly developed quality control system. The table below presents the comparison of quality control practices in Callebaut and Wawel companies, i.e. the range of analyses performed for the evaluation of chocolate products. It should be noticed here that the analyses of Callebaut relate to the industrial chocolate evaluation while analyses of Wawel are linked to the consumer chocolate production. The range of analyses performed by

Wawel seems to be very wide. The company does not have taste panel for a time being but has plans for its introduction in the next year.

Tab. 5. 6 The comparison of quality control practices in Callebaut and Wawel S.A according to the raw materials assessment, quality in production practices, final quality control and some requirements for storage of finished products.

QUALITY OF THE RAW MATERIALS		
RAW MATERIAL	***ANALYSIS AND APPROVAL***	
	CALLEBAUT	**WAWEL S.A.**
1. Cocoa butter	-Dynamic setting -UV-spectrum -Sensory check	-Dynamic setting -Moisture content -Free fatty acids -Melting point temperature -Refractive index -Iodine value -Saponification value -Kreiss method for epihydryne aldehyde -Organoleptic assessment -Heavy metals: As, Pb, Cd, Cu, Zn, Sn, Hg, Ni, Fe
2. Butter oil	-Sensory check -Total plate count (TPC) -Enterobacteriaceae -Certificate of analysis	not used
3. Powdered milk	-Moisture content -Total fat, free fat -Fineness -Total plate count (TPC) -Yeast and moulds -Enterobacteriaceae -Staphylococci -Streptococcus faecalis -Salmonella per 1500 g -Sensory check -Certificate analysis	-Organoleptic assessment -Moisture content -Acidity -Fat content -Enterobacteriaceae -Salmonellae per 25 g -Staphylococcus aureus -Enterococcus -Yeasts and moulds -Total plate count (TPC)
4. Cocoa beans	-Checks for live pupae, moths, humid or infested bags, abnormal smells and/or appearance -Checks for fermentation or defects on 100 beans	-Moisture content -Colour of the whole beans -Taste and odour of whole beans and kernels -Extraneous filth -Broken beans

	-Weight, water content, fat and bean husk -Sensory check on raw and roasted beans	-Slaty beans -Mouldy beans -Infested beans -Flaty beans

Tab.5.6. continued'

5. Cocoa powder	-Moisture content and fat -Total plate count (TPC) -Enterobacteriaceae -Yeasts and moulds -Streptococcus faecalis -Salmonellae per 1500 g	-Moisture content -Fat content -Acidity -Sedimentation characteristics -Heavy metals: Cd, Pb, As, Hg, Cu, Zn, Sn -Total plate count (TPC) -Moulds and Yeasts -Enterobacteriaceae -Staphylococcus aureus -Salmonellae per 25 g
6. Sugar	-Exit check reports from manufacturer: range of granule size -range of granule sizes -Check for free iron	-Moisture content -Granularity -Ferromagnetic admixture -Saccharose
7. Fats	-Sensory analysis -Tri-glyceride composition -Solid fat content	-Organoleptic assessment -Melting point -Free fatty acids -Dynamic setting -Kreiss method
8. Lecithin	-Taste -Effect on rheology in chocolate -Enterobacteriaceae -Salmonellae per 25 g -Certificate of analysis	-Organoleptic assessment -Phospholipids content -Acid value in acetonitril extraction -Lea value -Moisture content -Volatile components content -Salmonellae per 25 g -Enterobacteriaceae
9. Nuts	-Check for live pupae, moths, humid or infested bags, mould, abnormal odour and/or appearance -Moisture and fat content -Check for disease and visual inspection	-Microscopic check for disease -Organoleptic assessment -Check of mycotoxin analysis certificate -Moisture and fat content

10. Cocoa mixture of powdered milk and cocoa butter	-Heavy metals (Pb, Cd, Hg) -Pesticide residues	not used

Tab.5.6. continued"

QUALITY IN PRODUCTION		
	ANALYSIS	
	CALLEBAUT	**WAWEL S.A.**
1. Cocoa preparation: production of the cocoa liquor	-% nibs in husks and vice versa -Moisture and fat content -Particle size: material retained on 70 μm sieve -Viscosity	-% nibs in husks and vice versa -Moisture and fat content -Particle size checks
2. Manufacture of chocolate and nut products	• All production lines: - Check at each stage of: composition, mixing time, consistency -Check during refining phase of: pressure, temperature -Check during conching of: consistency, temperature -Linear viscosity of all products (Casson plastic viscosity and yield value if required) -Check on fineness for finished chocolate • Nuts -Process checks: roasting temperature, roasting time -FIFO (First In, First Out)	-Check of cocoa mass fineness during the refining -Check on temperature and time of conching -Viscosity after conching -Check on the accuracy of tempering process -Moisture content before and after roasting -Taste before and after roasting
3. Moulding the chocolate	-Checks: appearance, weight, metal detection	-Appearance -Net weight -Accuracy of use-by date

Tab.5.6. continued'''

FINAL QUALITY CONTROL		
	ANALYSIS	
	CALLEBAUT	**WAWEL S.A.**
End product	-Fat content -Total plate count (TPC) -Yeasts and moulds -Enterobacteriaceae -Salmonellae -Heavy metals (Pb, Cd, Hg) -Consistency and viscosity -Composition -Fineness -Net weight	-Moisture content -Acidity -Extracted fat content -Total Plate Count (TPC) -Yeast and moulds -Enterobacteriaceae -Salmonellae -Heavy metals (Pb, Cd, Hg, As, Cu, Zn, Sn) -Viscosity -Composition: sugar, additives (nuts, fillings, aspartame) -Fineness -Net weight -Organoleptic assessment

REQUIREMENTS FOR STORAGE OF FINISHED PRODUCTS		
	CALLEBAUT	**WAWEL S.A.**
1. Temperature	12-20^{0}C	max. 18^{0}C
2. Time	Moulded chocolates: -Plain chocolate: 24 month -Milk chocolate: 18 month -White chocolate: 12 months -Compound coating and nut products: 12 months	Solid chocolates: -Plain chocolate: 12 months -Milk chocolate: 6-9 months
3. Relative humidity	70%	max. 75%

So: Callebaut Quality System, 1994; Wawel information received in 1996

5.5 RECENT EU-REGULATIONS

In the consequence of Mutual Recognition in the EU, which goes back to 1979 „Cassis de Dijon" precedence, the free trade within the EU was achieved and strict rules in some Member States were changed by more permissive regulations. These changes in the EU trade may present risk of decreasing food quality and safety. In order to meet these threats the Commission issued the following regulatory directives for food safety and quality:

5.5.1 Denomination of Product Origin and Geographical Indication

According to Worley *et al.* (1995), quality differentiation is defined by the EC regulations n. 2081 and 2082 of 1992. The purpose of these regulations are „to enhance the value of products while providing consumers with clearly stated information concerning origin and processing methods". These regulations cover the following three aspects:

1. **Denomination of origin** (DOP), which applies to the products denominated with the name that comes from:

- The country or region where the raw material originates,
- The country or region to which the quality is related,
- The country or region where the product is processed (including the origin of raw ingredients).

2. **Geographical indication** (IGP), which is similar to DOP but applies to broader regions. This designation indicates the product which contain raw ingredients from the areas which are not inside the specified geographical area.

3. **Denomination of specificity**, which provides EC certification about the uniqueness of the product, in such a way that one or more its characteristics are outstanding, in comparison to similar products.

To obtain the above designations the manufacturer must follow a „production practices order", in which the characteristics of the product and method of its production are clearly defined. The registration form may be obtained from the associations of producers and/or processors in each EC nation and the whole procedure is controlled by the EC Commission.

The above designations may enhance the value of differentiated products and provide opportunity for those firms which claim distinct product attributes. However, on the other hand they may introduce economic risk through the following aspects :

- „Market myopia, particularly in identifying changes in demand,
- Difficulty in adopting new technologies of production,
- Difficulty in realising economies of size" (Worley *et al.*, 1995).

5.5.2 Labelling Regulations

Two directives related to the labelling requirements in foodstuffs were issued by the European Union. The general aim of these regulations is to avoid technical barriers to free trade and enhance competition among the EU nations. The European Union law prescribes the following characteristics of a proper label: product name, quantity, lot number (batch number), name of manufacturer, composition, origin of ingredients, method and location of processing. In Belgian food law the first four characteristics are mandatory, while the composition i.e. ingredient list and other above mentioned characteristics are optional. The „use by" date and some instructions, which appear on the Belgian chocolates, are also optional and left up to the company's decision. However, some chocolate companies, such as Callebaut or Kraft Jacobs Suchard, say that they must be „prepared when the national law is changed"; therefore, they show almost all these characteristics on their labels. In Poland the obligatory information on the food label are: name of the product; name and address of manufacturer; best before date (date of minimum durability); lot number; number of standard to which the product was manufactured; ingredients list; net weight and country of manufacturing (Appendix 1).

According to the EU directives, the labels which attempt unwarranted product differentiation with the false claims of some of the products characteristics are prohibited. Additionally, labels must not indicate any of the attributes that may prevent, help or make easier to treat some diseases. It seems to be obvious that overall social welfare may increase if the consumer has a wider choice of foods. However, he must be properly informed, by the adequate label content; if not, he will feel mislead, confused or dissatisfied.

5.5.3 Harmonised Safety and Hygiene Standards for Imported Products

Directive 92/59, of 1993, harmonises the rules that concern the product safety control and „requires each EC state to control an imported product's conformity to EC regulations in the absence of specific rules for the particular product" (Worley *et al.*, 1995). It may be said that the Single Internal Market, whose definition is "an area without frontiers in which the free movement of goods, persons, services and capital is ensured" (according to the Single European Act, 1987) has necessitated a range of hygiene Directive requirements, as from 1 January 1993 food produced in one Member State may be freely marketed in all the other EU nations. Basically, there are two types of hygiene control Directives: „Horizontal Directives" which are the general baseline hygiene standards and may be applicable to any food business, and „Vertical Directives" which apply to the specific product and cover stricter controls in areas of higher risk probability. These do not cover chocolate industry as low risk production.

Finally, the most important factor in the quality control is the consumer himself. The consumer sets up the desired standard, chooses the specific product, accepts or rejects it, he pays the retailer, producer and manufacturer and is changing his needs, wishes and preferences without any former warning.

6. TASTE AND SENSORY ANALYSIS OF CHOCOLATE

Nowadays, taste of chocolate is known almost to everybody. Myriad types of chocolate available through the world compete as far as taste, flavour and quality of this unique product is concerned. Leaders of the chocolate industry try to attract potential consumers by various practices. These may be unusual taste, extraordinary appearance, quality assurance mark or captivating price. For many consumers however the price do not need to be very low.

Is it a typical taste or maybe another characteristic feature that we remember and associate with a particular kind of chocolate? Would it be easy for each of us to answer a simple question: what is your preferable brand and type of chocolate? May be second part of this question is answered immediately by majority of us, but would it be so obvious for brand preferences?

6.1 INTRODUCTION TO TASTES OF CHOCOLATE

Why is the European chocolate so different from the English or the East European one?

A lot of factors affect the answer to that question. In spite of the fact, that there is almost nobody who can fully explain this phenomena, we will try to indicate here some of the possible influences. In the majority of different classification systems, such as Polish standard entitled: „Wyroby Cukiernicze Trwałe. Badania Organoleptyczne" (1970), (Durable Confectionery Products. Organoleptic Assessment), taste is perceived as the most important factor and scores the highest percentage value among all factors which contribute to the total quality of chocolate.

In the current approach the difference in taste is explained from two different points of view. The first is the objective on technology point of view. The idea is to analyse the ingredients and to consider the possible change of the components to produce chocolate. The second is the subjective consumer point of view. By means of sensory analysis taste of different kinds of chocolate by a group of consumers is investigated. Step by step the attributes of six brands of chocolate are analysed and

the difference in perception is noticed. Finally, some conclusions are made from the taste panel analysis.

6.2 INGREDIENTS AND PROCESSING MAKE TASTE OF CHOCOLATE

Taste may be influenced not only by ingredients but also materials in contact with chocolate. It may be changed diametrically during processing and storage time. Here we consider only the main ingredients: cocoa beans, sugar and milk. It is also well known that some particular additions give a specific taste to chocolate. Additionally, emphasis on fermentation and roasting of cocoa beans as a fundamental factors influencing taste of chocolate is presented.

6.2.1 Cocoa beans

The biggest potential influence on flavour of chocolate products is considered to come from the cocoa beans. There are many botanically different cocoa beans. The main varieties are Forastero and Criollo which differ in flavour and aroma:

- Forastero - general filler-type of bean, gives the characteristic strong cocoa flavour, and inclines to be bitter,
- Criollo - a variety of the fine-grade flavours, may be variable but is generally light-coloured and contribute to the unique mild and nutty flavour.

Apart from these basic types of cocoa beans, there are many hybrids considered as Forastero types like Nacional and Arriba that have distinctive aromatic floral notes (Jackson, 1994).

It should be remembered that about 34% of all exports come from Ivory Coast and Ghana and that has a paramount influence on taste of the European chocolate (Nuttall, 1994). Growing conditions and cultivation as well as differences in handling and fermentation processes are significant for taste of final product. Each location provides its individual flavour and thus the overall flavour of some chocolate changes as new sources and types of cocoa beans are introduced. The following table considers the countries of cocoa beans origin and the generally accepted flavours and aromas.

Tab.6.1 Sources and short characteristics of cocoa beans

MAJOR SOURCES	CHARACTERISTICS
Brazil	Acidic in nature with „smoke bacon" notes
Nigeria	Generally good all-round beans but lack distinctive flavour
Ghana	Similar to Nigeria but flavour considered in some circles a little better than Nigeria
New Guinea	A fine-grade aroma bean but quality varies between estates
Trinidad	A good-quality bean with some particularly fine flavour - has varied over the years
Venezuela	Some good-quality flavours (Criollo), but crops of lower grade have been known
Ivory Coast	A variable quality crop, weaker in flavour than Nigeria or Ghana
Malaysia	Very acidic in nature with weak cocoa flavour
Cameroon	Different flavours to Nigeria and Ghana - is variable and smokiness is prevalent
Sierra Leone	Is generally under-fermented and has green notes

So: Jackson, 1994

6.2.2 Sugar

The next basic ingredient of every chocolate is sugar. In majority the cane sugar comes from Fuji, Mauritius, the West Indies and Cuba. It should be noted that some countries do not import sugar and depend on the national sugar-beet production, like Poland does.

Sugar contributes to the flavour and the change of its content from 1 to 2% has a great influence on the sweetness and total cost of chocolate production. In dark chocolates sugar is added for flavour purposes as to reduce the bitterness of cocoa solids. It can also have an effect on processing techniques like caramelization in milk chocolate. The process is particularly important in crumb-based chocolates, mainly of the English origin. While most of the processing is done continuously under vacuum, milk protein and sugar undergo a chemical change called Maillard reaction and the obtained mass takes a typical mild caramelised flavour.

6.2.3 Milk

The third constituent - milk - is essential to flavour, colour and texture. It also influences the glass and shelf life of chocolate products.

It is important to note that milk chocolate is the most popular among all types of chocolate and its nutritional value is higher than of dark sweet chocolate. That is shown in the following table.

Tab.6.2 Nutritional comparison of milk chocolate and dark sweet chocolate on a 100g basis

NUTRIENT	DARK SWEET CHOCOLATE	MILK CHOCOLATE
Calories	540	540
Protein (g)	6.2	8.1
Fat (g)	30.2	30.9
Total carbohydrate (g)	60.6	57.7
Crude fibre (g)	1.0	1.1
Sodium (mg)	10	**75**
Potassium (mg)	340	410
Calcium (mg)	19	201
Phosphorus (mg)	160	310
Magnesium (mg)	115	65
Iron (mg)	2.1	1.1
Zinc (mg)	1.5	1.3
Copper (mg)	0.8	0.4
Manganese (mg)	0.8	0.3
Vitamin A (IU)*	20	60
Thiamine (mg)	0.02	0.08
Riboflavin (mg)	0.24	0.36
Niacin (mg)	0.67	0.36

*IU - International Units expressed as 0,6 μg of pure carotene
So: Hershey, 1986

Addition of milk enhances the nutritional value of milk chocolate because of the increased content of milk proteins, Calcium, Phosphorus, Potassium and also vitamins A and B. The only negative impact on the nutritional value of milk chocolate is the increased content of Sodium, although it can be modified accordingly to the individual product formulation.

Basically, there are three distinct milk flavours due to the usage of three different states of milk: fresh, matured and processed milk.

While preparing a chocolate from fresh milk the producer takes advantage of capturing the original flavours of fresh milk. However, this process is very rare.

Matured milk can be enzymatically or microbiologically changed or ripened. That type of milk with a flavour described as „barnyard" or „cheesy" has been used in the USA for many years. The flavours are known as the American type of chocolate flavours and are also known as lypolyzed flavours due to the lypolyzation of milkfat into the free fatty acids by lipase enzymes. Here a sensation of richness is detected at low levels of lypolysis - because of the unique fatty acid composition of milkfat. Additionally, cream and buttery flavours are detectable as the lypolysis reaction increases and a cheesy flavour becomes a characteristic one at the higher degrees of the process (Nelson, 1972). The major free fatty acids contributing to this type of flavour are butyric, caproic and capric acids (Kinsella, 1970). Although this reaction is undesirable in most food products it provides a unique and important functionality of the milkfat in milk chocolate of American origin.

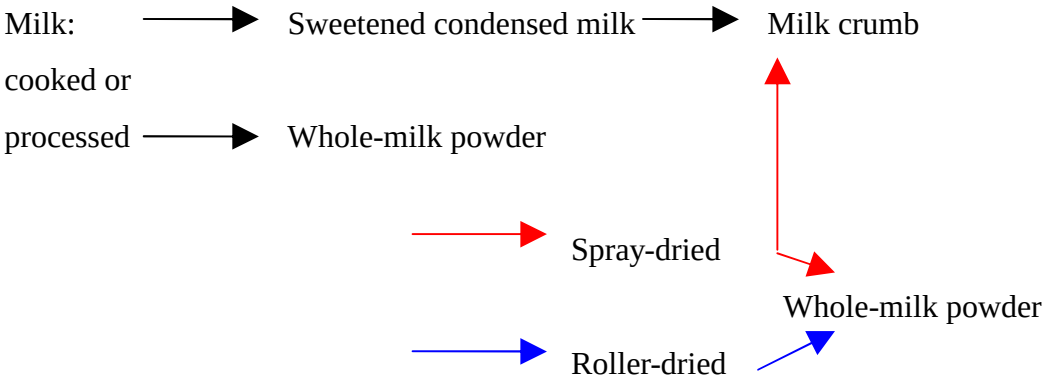
The third type of milk which may be used in the process of chocolate manufacture is processed milk. Here the flavours are obtained while fresh milk is cooked in the presence of sugar as to create condensed milk. The flavours which are developed due to the previously mentioned Maillard reaction, might be found in many European types of chocolate confectionery. During this reaction various degrees of roasted or caramel type flavours are created. A caramel type flavour is considered the most popular worldwide flavour and is very dependent on temperature and time resulting in key flavour components such as furfurol and maltol.

Nowadays, two major forms of milk are used in milk chocolate production. Spray-dried whole-milk powder and sweetened condensed milk which is used to manufacture of the milk crumb. There is a debate over the years on the differences between the flavours of spray-dried milk powders and roller-dried powders. The problem of spray-dried whole milk is that the milkfat is largely absorbed inside the lactose-protein structure of the dried milk particle (Musser, 1970).

A roller-dried whole-milk powder is more functional than spray-dried one, because of the fact that approximately 90% of the milkfat in roller-dried milk is available as free fat in comparison to 3-6% of that available in spray-dried method. The result of this difference is that milk chocolate made from spray-dried milk

powder requires the use of 2-3% additional, expensive cocoa butter to maintain the handling properties during manufacture. There are also differences in the mouthfeel perceptions of the final product (Verhey, 1986). The following figure summarises the paths of milk processing for products which find the application in chocolate manufacture.

Fig.6.1 Milk products used in chocolate manufacture and paths of their preparation



Coming back to the types of milk used in chocolate industry it has to be noted that large manufacturers are more likely to produce milk crumb, while smaller companies are willing to purchase whole-milk powder for milk chocolate production. Milk powder chocolate is usually more bland tasting, lighter in colour, slightly dryer and softer textured. The most common flavour contributions by whole-milk powder are: aldehydes, ketones and carbonyls formed by the auto-oxidation of milkfat. According to Kinsella (1970) lactose and pyrazines may also contribute to flavour.

Milkfat of whole-milk powder gives a typical smooth flavour and texture in milk chocolate. It has an impact on softening properties and low viscosity and moreover provides economic advantages since it is less costly than cocoa butter (Jordan, 1986). Additionally, it prevents fat bloom and its more polar components, such as phospholipides and monoglycerides act as emulsifiers (Kinsella, 1970). However, the most functional action of milkfat in whole-milk powder is perhaps its ability to become part of the continuous fat phase as a result of its compatibility with cocoa butter.

The final functionality of milk powder in chocolate is in providing a lighter colour. This is influenced by a number of factors, including milk content, particle size, chocolate liquor content, fat content, cocoa bean processing and density. Milk chocolate made from milk powder is lighter in colour than chocolate made from milk crumb, because of the higher amount of air present in spray-dried milk.

In conclusion, it is believed that milk powder chocolates usually possess a lower total flavour profile than milk crumb chocolates (Heathcock, 1987). That is due to the milk solids in powder form which are less likely to undergo reactions with other components, such as sugars, as a certain amount of water is required for flavour reactions. For this reason, some manufacturers reconstitute milk in powder form into a condensed milk form and then reprocess it into milk crumb.

A typical milk crumb composition consist of 26-35% whole-milk solids, 13-18% chocolate liquor and 50-65% sucrose (Campbell, Pavlasek, 1987). Technology of milk crumb production is based upon making sweetened condensed milk, adding cocoa mass (liquor) and then drying the mixture under vacuum. The moisture content is reduced to a low level of about 1-2%.

A major advantage of milk crumb is its superior keeping quality which is attributed to the natural antioxidants in the chocolate liquor portion and in this form milk crumb may be stored for subsequent use in chocolate some months later. That implies another advantage, that is the cost benefit. The long shelf life of milk-crumb means that it is normally available at lower costs and then it can be stored again The next advantage of milk crumb relates to easiness of development of various milk-based flavours and to the nearly total availability of free milkfat.

Flavours developed during the crumb manufacturing process result from breakdown of unsaturated bonds by oxygen. They may be offensive by themselves, but after blending with other flavours present in milk chocolate become characteristically pleasant notes (Campbell, Gilmore, 1983).

In the end it should be indicated that experiments with whey and caseinate substitutes of milk had been done and the researchers found the objectionable flavours in such chocolates (Mohler *et al.*, 1981).

The interviews with Belgian and Polish chocolate companies show that all of them use spray-dried whole-milk powder. The roller-dried method is perceived as

more expensive and not used by Polish chocolate manufacturers. Crumb based chocolates are typical as far as English producers are considered.

6.2.4 Processing

Not only raw materials influence the true chocolate flavour but also all processes involved in preparation of cocoa beans and preparation of cocoa liquor are of great importance.

The first fundamental stages of chocolate aroma formation are fermentation in tropical conditions and roasting. The nature of flavours depends also on the degree of roast, the extraction method and the simple fact whether is it obtained from alkalised or unalcalised nib. During the roasting process many volatile compounds of cocoa beans are developed. The major component of the extract (by hexane) is linalool together with a variety of acids and esters. Around the end of 1960s number of identified volatile compounds rose to 200 (Kirk, Sawyer, 1991). One of the research works shows that amino acids and sugars are connected with the formation of „aroma" compounds. Additionally, the following compounds are included into the non-volatile components of chocolate flavour:

- Flavonoids - in form of polyphenols like catechins and anthocyanins
- Amino acids - which contribute to bitter or sweet tastes
- Organic acids, phenolic acids - their individual as well as collective influence is uncertain, however they are important as a large range of them has been isolated
- Carbohydrates - glucose and fructose prevailing to sucrose are present, these flavouring substances are developed from the degradation of sugars while heating (Rohan, Steward, 1967).

Additionally, in 1986 the research done at Penn State University in the USA, together with support of Confectionery Manufacturing Association (CMA), indicated that polyphenol oxidase (PPO) isolated from cocoa beans contribute to the development of chocolate flavour and colour (CMA Report, 1986).

According to the present state of knowledge about taste of chocolate, during the roasting process of cocoa beans the formation of various pyrazine, imidazole, pyrole and pyridine derivatives is confirmed. Specific aroma of chocolate and cocoa is developed in the reactions of phenylacetaldehyde from β-phenylalanine and 3-

methylbutanal from leucine, respectively. 5-Methyl-2-phenyl-2-hexanal responsible for this aroma is formed in the aldol-type condensation of both carbonyl compounds (Sikorski, 1994).

Texture is another very important factor in consumer acceptance of chocolate. In majority taste used to be synonymous with texture. The solids of British chocolates are refined to an average between 20-30 μm (8-12 x 10^{-4} in), while the European chocolates range between 15-22 μm (6-9 x 10^{-4} in). That is not true that all chocolates fit this profile. Chocolate refined to over 35 μm (1-4 x 10^{-3} in) can generally be detected as „gritty" and „sandy" and is not very well accepted. The exception could only be chocolate for filled bars or enrobed bars where the centres of the bars influence the „texture" more than chocolate. On the other hand, chocolate and coatings under 15 μm (6 x 10^{-4} in) are considered as „greasy" and „clinging" and are also not acceptable as good eating chocolates (Jackson, 1994).

Structure of chocolate products can be measured by the scanning electron microscope. It has been found that a texture of milk crumb based chocolate is significantly different from that of milk powder. Scanning electron microscope studies indicate a more intimately knit physical structure in crumb based chocolate. The close association and interaction of milk, sugar and cocoa in a fat medium results in a creamy mouthfeel, as opposed to the waxy, slimy and mouthcoating sensory attributes of milk powder based products (Heathcock, 1987).

6.3 SENSORY ANALYSIS OF LEADING CHOCOLATE BRANDS IN BELGIUM, THE UK AND POLAND

6.3.1 Aim of the sensory analysis

The aim of the sensory evaluation of different types of the Belgian, English and Polish chocolates was to evaluate organoleptic attributes of these chocolates and to undertake some trials in assessing the approximate preferences of consumers. The comparison on taste between chocolate from the three countries is in correspondence with the difference in food legislation, technology and habits.

By the taste panel approach the perception of the chocolate is measured and analysed. Especially in the perspective of enlarged EU and the worldwide

competition between food industries, the attitude and behaviour of consumers are the base of perceived quantity of sales evolution and prosperity of the company.

6.3.2 Methodology

To obtain reliable result from sensory evaluation all members of sensory panel should be selected for taste ability for taste differentiation and taste acuity.

6.3.2.1 Tests used for chocolate evaluation

The sensory panel invited, which consisted of students from different parts of the world (Appendix 2), had to be checked with regard to the ability of differentiation. Therefore, the first day of the experiment was devoted to three discriminatory tests.

6.3.2.1.1 Discriminatory Analysis

The discriminative difference tests are used for judging and establishing the difference between products without reporting the magnitude or direction of difference. In this case there is no need for specially trained assessors. The samples should be labelled with three-digit codes to prevent biased results. The following three tests were used for the evaluation of sensory panel:

- **Basic Tastes** - Primary recognition test (Gridgeman, 1967),
- **Ranking Test** - Threshold determination (O'Mahony, 1985),
- **Triangle Test** - Simple sensory test (Baryłko-Pikielna,1975).

Basic Test, known also as Taste Daltonism Test, is based on the recognition of four basic tastes i.e.: sweet, salty, sour and bitter. The subsequent solutions are prepared in the specially established concentrations. For sweet taste 0.8% of aqueous solution of saccharose is used. For salty taste 0.25% of sodium chloride solution is prepared. Citric acid in 0.03% concentration is used for sour taste and quinine in 0.0045% for bitter one. Assessors are asked to recognise each sample of different solution and the positive result is achieved when three of these samples are well identified.

Ranking Test, is based on the intensity rating scale of one chosen taste. Taking into account the main product of these analyses, chocolate, the Ranking Test was

prepared on sweet solution. Aqueous solution of saccharose was prepared in four different concentrations as follows: 0.8%, 0.6%, 0.4% and 0.2%. This test and the previously described test are usually applied in the determination of the assessors ability to differentiation and the level of recognition of the specific taste. Three out of four presented samples have to be well recognised.

In the last test called - Triangle Test - the three samples of a product are presented to the assessors. Only two of them are identical and assessors are requested to taste each of product and indicate the odd one out. This method is useful in determining whether there is an overall difference and is in widespread use by Taste Panels in many chocolate producing companies. The Triangle Test was prepared on the example of milk and orange juice therefore, each of the panellist had to evaluate two sets of samples. One positive answer out of two gave a good result.

From 20 initially invited assessors only 10 passed the discriminative tests and their answers were only taken into account while compiling the results afterwards.

6.3.2.1.2 Descriptive Analysis

After the selection of sensory panel one descriptive test: Attribute Test and Hedonic Scale Test were performed on chocolate bars of various origin. Descriptive tests, also known as sensory profiling (QDA) are the most sophisticated technique available at the moment. In spite of the fact, that these methods are time-consuming and labour-intensive they provide much more information than a discriminatory tests.

The assessors chosen for these tests must be able to detect and describe the perceived qualitative sensory attributes. The aspects such as the appearance, taste, flavour, texture and odour should be clearly distinguished and ranked according to the intensity of a sample. Different factors such as age, sex, background or education influence the perception of the sample therefore, as much time as possible should be devoted to be sure that all assessors mean the same thing while describing a certain attribute (Leissner, *et al*., 1991).

In these methods it is important to train the assessors for the ability of recognition and memory building of the given samples. This requirement was achieved only in some extend as the panellists were given samples of milk chocolates only with the short inscription what they are supposed to do on the following days (chocolate main tests). The chocolates they were given were not of the brands which

were going to be assessed. The „Milka" of Suchard Jacobs and milk chocolate sold under a name of „Kruidvat" were as the „reference samples" on that preparing day. The first chocolate was told to be the most characteristic and milky while the second one was perceived as a hard and rather plain-type chocolate. Additionally, the panellists were given in advance a table of different mark scale examples (Appendix 3) characterising the attributes which were going to be assessed.

The following tests were performed in the second part of the experiment:

- **Attribute Test** - Attribute testing (Leissner, 1991),
- **Hedonic Scale** - Preference testing (Maximo, Jagbir, 1984).

The Attribute Test was based on the Polish standard (BN, Wyroby Cukiernicze Trwałe, Badania Organoleptyczne, 1970) and consisted of the assessment of ten attributes. The example of the sheet used for this test for milk chocolate with hazelnuts evaluation is included in Appendix 4. Each of the attributes assessed such as packaging, shape, colour or taste were quantitatively described on the Mark Scale ranging from 0 points for the less acceptable characteristics of the sample to Maximum points for the most liked ones. The answers were counted with a ruler as the Mark Scale has 10 cm length and then the average values for each brand were calculated. The additional comments for e.g. nuts were asked as well as the assessors data like nationality, age and sex. Samples were only numbered but not coded. The chocolate bars were cut simply by a knife and the company's logo was seen in majority of cases. The author realises that this could have an influence on the result obtained.

The example of second test - Hedonic Scale Test - is presented in the Appendix 5. Here the milk chocolate was assessed in 9 point scale. Numerical values ranging from 1 (dislike extremely) to 9 (like extremely) were then calculated and mean values were used for the presentation of the „Percentage share of consumer acceptance" (Appendix 9-11). The Hedonic Scale Test, developed in 1947 at the Quartermaster Food and Container Institute for the Armed Forces (Maximo, Jagbir, 1984) defines the psychological attitudes of „like" or „dislike" in a linear scale. This test is the most popular one for preference evaluation and often used by market researchers.

The following leading chocolate brands from the three countries were taken into evaluation:

- **Callebaut, Cote d'Or** (Belgium),
- **Cadbury, Terry's** (England),
- **Wedel, Wawel** (Poland).

This part of the experiment consisted of the three sessions, each of them was performed at the same time on the three following days. Every day the panellists

were asked to evaluate different types of chocolates: milk chocolate on the first day, plain chocolate on the second and milk chocolate with hazelnuts during the third day.

6.3.2.2 Samples, panellists and environment.

Designation of sensory analysis is of paramount importance. The following aspects were taken into account while preparing the evaluation of chocolate: presentation of samples, panellists and environment (Pierson, 1995).

6.3.2.2.1 Presentation of the samples

- Because of the attributes which were going to be assessed the presentation of different types of chocolates was not uniform. One cube of chocolate, from six brands within one type of chocolate, was given to each of the panellists. It would not be possible to assess the attributes like snap or surface while homogenising a sample, therefore it was decided to give the assessors the confidence in unbiased judgement,
- The order of samples presentation was randomised and different for each replicate test,
- Plates for sample presentation were identical, odour-free and tasteless,
- All assessors received identical amounts of samples, sufficient to taste with confidence and to give a feeling of „mouthfulness”,
- The number of samples assessed in one session depends on their intensity and on the food. It is also well known that the fatigue occurs even for weak and bland foods, so 2-8 samples per session are recommended. Here, 6 samples were prepared,
- As to develop full flavour sensations of a sample the swallowing should be avoided. Therefore, it was strongly insisted on, through giving the panellist the opportunity for degustation after each session,
- Assessors were supplied with the glass-bottled water, in odour-free cups, for mouth-rinsing and also with the second cup for splitting. Additionally, bread was distributed in each box for cleaning a palette,

- Printed forms were used to give instructions for tasting and recording of results. It is believed that the instructions were simple and clearly laid-out for ease of understanding,
- A limited amount of information was given before analysis begun, however it is supposed as it was sufficient to explain but not to influence the assessment,
- Assessors were not rushed but they were informed on time limit of about 10-30 seconds per sample as not to forget the sensation.

6.3.2.2.2 Panellists

- Assessors were asked not to introduce odours into the assessment area, e.g. by means of cosmetics,
- They washed their hands with unscented soap before the analysis started,
- Food consumption was not allowed during the period of 0.5-1 hour before analysis,
- Smokers were asked not to smoke for 0.5-1 hour before assessment,
- The health of the panellists was taken into the consideration, on the forms given they could indicate their health condition on the specific day. Basically, they were not suffering from any cold,
- Assessors had no chocolate prejudices, they claimed strong or moderate passion towards this kind of product,
- According to the literature, the minimum number of judges who will agree in the preference testing, is 14 out of 18 invited. The twenty people were initially invited as it was impossible to predict how their senses would work and because of the fact that the laboratory had only 6 booths available (that means that having 3 rounds in one day [3x 6 panellists] made the work as efficient as possible),
- Assessors invited came from Europe in half and from other continents for the other half, out of 20 judges (one did not come),
- The sex of the panellists was also equally divided 50 per 50 %,
- The most uneven distribution was the age of panellists, which ranged from 50 (1 person) to 24 (for 6 persons),

- The codes were given to all of the panellists as to ensure them about non-prejudice of the person who checked the tests. In the second part of the experiment, when the main chocolate analyses were performed, the panellists were asked about their age, sex and country as to draw some conclusion afterwards.

6.3.2.2.3 Environment

- A suitable area of proper dimensions (i.e. the individual booths) was available. The area was tidy and isolated from any interruptions and distractions,
- The samples were prepared in a separate laboratory which was free from any odours of samples,
- The walls were of a natural colour (white) as to promote concentration of the assessors,
- Uniform and adequate lighting was not provided, the assessors complained that in some booths the light was not sufficient,
- Independence of assessors was kept as well as quiet was guarded,
- The analyses were undertaken within preferable hours (i.e.: from 9.30 a.m. to 12.00 noon and from 2.30 p.m. to 5.00 p.m.). Difference tests were performed at 14.00 p.m. and the main chocolate assessments at 4.30 p.m.,
- Monday mornings were avoided, but it was impossible to avoid Friday afternoons! (because of a very stringent time-table of many students).

6.3.3 Results of sensory analysis

Firstly, it has to be commented upon the sensitivity of panellists invited to the experiment. The first three discriminatory tests showed that only half of the assessors invited appeared to be enough sensitive judges. Secondly, it should be disclosed that for descriptive tests, such as Attribute Test and Hedonic Scale Test, all previously used panellists were invited. They were in majority very busy students therefore it was difficult for them to attend the four days' analyses. This influenced the decision about the invitation of all of them to enhance their motivation. However, it must be stressed here that only these data which came from the judges who had successfully passed the discriminatory tests were taken into consideration.

Experiments with the international panel showed that there are significant differences between 6 chosen brands of the East and West European and English chocolates, as the last one may want to be in the separate category.

Results obtained from the Attribute Test are graphically presented in the form of tables and corresponding spider plots (Appendix 6-13). A spoke denotes each attribute and the distance of the attribute mean from the centre of the plot along each spoke directly corresponds to the intensity of attribute which had been measured. This kind of plots provides a visual presentation of any similarities and differences occurring between the products.

Generally, it is noticed that Belgian brands with only few exceptions gained more scores according to majority of attributes evaluated. Majority of panellist agreed that taste and package are the most important attributes while assessing chocolate. Therefore, discussing three spider graphs for milk, plain and milk with hazelnuts chocolate, it can be remarked that the highest amount of points within each type of chocolate scored:

- Milk chocolate: **Côte d'Or** for *package* and **Callebaut** for *taste* (Appendix 6),
- Plain chocolate: **Terry's** for *package* and almost equally **Callebaut** and **Côte d'Or** for *taste* (Appendix 7),
- Milk chocolate with hazelnuts: almost equally **Callebaut** and **Cadbury** for *package* and **Côte d'Or** for *taste* (Appendix 8).

Polish chocolates were disliked especially for their taste. Additionally, the attributes like odour, smoothness or hardness were distinguished as unwelcome features. However, for a few attributes Polish chocolate gained higher amount of points then some of their competitors. The following attributes may be mentioned:

- Plain chocolate: **Wedel** was ahead of the English brands in shape, surface, colour and snap (Appendix 7),
- Milk chocolate: **Wedel** was better assessed than English brands and also then Côte d'Or for the shape, surface top, colour attributes (Appendix 6),
- Milk chocolate: **Wawel** gained more points then English brands as well as Callebaut for colour attribute in, thus being on the second place after Côte d'Or (Appendix 6).

The analysis of Hedonic Scale testing shows that Callebaut and Côte d'Or were the most popular brands for all types of chocolate, among 6 brands evaluated. The percentage share of consumer acceptance for Callebaut was the highest and

around 22-23% of all brands evaluated in each product type. The second position held Côte d'Or. It is remarkable that for plain type of chocolate both companies received the highest amount of points (Appendix 10).

English brands' share was around 15-18% and Terry's was ahead of Cadbury in milk and plain chocolate by 1%. For milk chocolate with hazelnuts Cadbury won with Terry's gaining 3% more consumer acceptance (Appendix 11).

The percentage share of consumer acceptance for Polish brands remained stable (10-13%) and only in case of milk chocolate with hazelnuts Wawel received more 2% (Appendix 11).

In the Appendix 12 the individual assessors' preferences for each type of chocolate are presented. It is significant that milk types of all chocolate brands gained more points then plain ones, with the one exception. From the data obtained it may be concluded that, in many cases, the assessors from the Eastern part of Europe and the Far East gave more points to Polish chocolate than the assessors from Western Europe. In addition, it was observed that panellists from the American continent did not liked the East European taste of chocolate. It is not surprising observation since we know that they used to the lypolysed taste of chocolate which dominates on this continent.

In the last Appendix 13 the indications of consumer preferences for milk, plain and milk with hazelnuts chocolate are presented according to each brand taken to evaluation. This graph compares data presented in Appendixes 9-11.

6.4 CONCLUSIONS

The significant difference in consumer preferences is observed in the sensory analysis of Western and Eastern type of chocolates. In conclusion it may be said that consumers' preferences basically approach towards the West European taste of chocolate. It should be however remembered that the analysis was done with a small

number of panellists. Therefore, the obtained and compared data may only be the indicators for the future more complex and developed research.

In the food industry one of the tools of quality assurance is monitoring based on sensory analysis. The human senses are instruments that are much better than any chemical or physical analysis in terms of sensitivity and speed. The expert sensory panels are often used in big chocolate producing companies for quality control purposes. Using a descriptive analysis they are able to identify, describe and measure all the perceptions. It is however only possible when the sensory panel is well trained and there is an experienced leadership during these sophisticated analyses. Descriptive analysis is believed to be the best available means when the complex and detailed analyses are considered. It can be applied to product development, process modification and shelf-life testing (Leissner, *et al.*,1991). Other applications include competitive analysis, package performance and quality assurance aspects.

The Attribute Test used in this study was a simplified version of descriptive analysis. The vocabulary of attributes assessed was not prepared by assessors but was given to them. Moreover, they were provided with a „guide" which explained the meaning and proper interpretation of each attribute (Appendix 3). The panellists were not fully trained but just a little bit prepared for the main evaluation of chocolate.

Results show that for the time being the prospects for the success of Polish chocolates in the international market are rather unpromising, especially because of taste and not fully European content of their labels (Appendix 1). Information on labels about cocoa and milk solids content is still not available as there are many differences between Polish and West European legislation requirements and methodology of quality control inside the chocolate industry.

The present status of standardisation within the field of sensory analysis is believed not to fulfil the criteria of those involved in the sensory research. According to Gemert (1995), the „European food industries should realise that more efforts have to be made in order to ensure that future sensory standards are adequate and are based on sound scientific principles".

The chocolate manufacturers in Belgium have already realised this need and they control the quality of their products by the regularly working sensory panels.

Callebaut employs 100 people for sensory team, while Côte d'Or has 30 panellists. Both companies apply the triangle tests for sensory checks and use the statistical methods for the obtained data evaluation. The sensory panel of Callebaut works on the everyday basis and the company claims that there is no support of analytical methods for taste. The company states that „Everything can change except taste". The panel of Côte d'Or operates after each change in the technology and after the introduction of new raw materials. Polish manufacturers also recognised the importance of sensory panels and started to create them as Wawel does.

In the future when the European standardisation programmes will eliminate hidden technical barriers to trade and the availability of the wide range of products, also from the West European countries will increase, the customer preference for certain product may change. Polish companies will also be forced to meet new taste preferences of new and even old, loyal customers.

7. GENERAL DISCUSSION

Chocolate makes a contribution into the nutritive diet. Chocolate is an excellent type of product that may be given to somebody with a special wish or dedication. In many cases, a gift of chocolate is a common way of expression of love or affection, gratitude, hospitality or even remorse. It is observed that a demand for special chocolate products varies with peaks at Christmas and Easter Time.

Without any doubt it may be stated that chocolate confectionery is eaten worldwide giving a lot of enjoyment and fun. Chocolate bars of various shapes and tastes are convenient snacks and are treated as a welcome interlude. Being a small volume source of energy, energy which should be rapidly replenished after the intensive day, these kinds of products have also special destination, like that of being the constituent of food packs during rescue actions or mountain climbing.

It should not be forgotten that much has been said about supposed harmful effects of chocolate. However, most of the statistical evidence of some medical researchers is build on the abnormal intakes of carbohydrates. The illnesses like ulcers, athero-schlerosis, hyper-activity, addiction and dental decay are connected with the consumption of chocolate confectionery (Minifie, 1980). Confectionery is accused of making people fat or obese and this is one risk factor which is linked to coronary heart disease (CHD). Therefore, control and in some cases reduction of sweets consumption, including chocolate, and regular oral hygiene, together with the fluoridation of water, may reduce potential threat that comes from eating confectionery.

While defending the chocolate, it should be noted here that in 1986 a group of American researchers analysed data from experiments in animals which related to the cocoa butter's effect on blood cholesterol. The preliminary findings indicated that serum cholesterol levels in animals which were fed cocoa butter were lower than those fed corn, coconut or palm oils (CMA Report, 1986) due to the major saturated fat in cocoa butter, that is stearic acid, which shows a neutral effect on these levels. More recent reports show that chocolate contributes to increase in high density lipoprotein cholesterol (Kris-Etherton *et al*.,1994) which is of particular importance in prevention of, previously mentioned, athero-schlerosis and coronary heart disease.

Additionally, the results from the initial investigation on potential benefits of cocoa consumption on lactose intolerance proved the former observations that if we add the cocoa to milk the mean breath hydrogen and symptoms of lactose malabsorption decrease (CMA Report, 1986). It was also shown that certain foods such as cocoa have cariostatic components which neutralise the plague acidity, thus assisting in re-mineralisation or inhibition of the bacteria (Nuttall, 1994).

There are many factors influencing the development of chocolate industry in Europe. In spite of the fact that, cocoa beans, the main constituent of chocolate, originate from the American continent, the idea of chocolate mass-production started here in the Continent, where the fashion of drinking chocolate beverage was closely related to the wealth of people. In the beginning, only the rich ones such as royal or merchant families could afford chocolate drinks. Then, in one of the most developed countries in these times, Switzerland, the production of eating milk chocolate started because of a few factors such as: big milk supply, invention of a new technological process and soon afterwards the introduction of a conching machine with the aim of improving smoothness of chocolate particles.

The year in which the conching machine appeared in the chocolate industry, 1879, may be called a turning point. Since this year chocolate consumption has steadily increased due to the excellent characteristics of new solid chocolate, which has the additional advantage i.e. it does not increase the feeling of thirst as drinking chocolate did.

The consumption and production rose throughout the years. Countries with the leading position in the chocolate supply and demand such as Switzerland, Austria, the Netherlands, Germany and the United Kingdom had close contacts with the producers of cocoa beans as many of these countries had their colonies in Africa and the Far East. The oldest chocolate companies were the family businesses like those of Suchard, Jacobs, Callebaut, Cadbury or Mars. Then the processes of merges and acquisitions started and have continued until present time. Now, in the twentieth century, all of these companies have already realised that international relations and mutual dependence are the basis of global, profitable strategy.

Therefore, it seems unimportant whether some companies, such as Cadbury, think (from rather Ptolomeic point of view) that „Cadbury has build its reputation on

the fact that when people move away from Britain they take their chocolate preferences with them" or like Nestlé that „Tastes for chocolate change from region to region and ... no two bars taste the same from one country to the next as taste has been adapted to suit national preference" (Maynes, 1993). All of these companies are right if they serve local preferences in respect of population, its needs and expectations. The prospects for the chocolate industry are clear and promising. The consumption levels in some countries of Western Europe reach 9 kg per capita per year. Since the international groups of chocolate manufacturers went into Asia or Central and Eastern Europe, the trend towards higher consumption has been noticed there, which may be also associated with the increased income of these nations in the recent times.

Wider availability of chocolate brands in the European market produced by well known, reputable companies and also by small unknown factories forces governments to take precautions against any adulteration or even poisoning of potential customer. The real first work on consumer protection was done by the American writers called „muckrakers" in the nineteenth century. However, the first consumer protection law in a form of „consumer bill of rights" was formulated by President Kennedy in 1960's and covered the following aspects: right to safety, right to be informed, right to choose and right to be heard (Viaene, 1995). It is well known that consumers have their own rights and may be very serious in the crucial matters. Therefore, the European Union foodlaw covers many aspects which aim at consumer protection such as the Labelling Regulations, Denomination of Product Origin or many vertical regulations relating to the specific products, such as chocolate, where the content of these products is assured. In addition, many Member States prepared and enforced regulations based on the EU directives. The example is the English law covering e.g. the Weight and Measure Act, the Food Safety Act and so on. The foodlaw is established to protect consumer rights and also to ensure fair trade within the Union and associated countries such as Poland. In case of chocolate products, regulations tend to establish the minimum content of cocoa and other constituents and contribute to the increased liaisons between the countries in which chocolate manufacturers operate.

There are many aspects of legislation for chocolate. The most important composition requirements are clearly established (Council Directive, 1973) and if the company wants to sell for the Single European Market it must comply with these requirements. One sensitive aspect is related to the cocoa butter substitutes. However, the rule of 5% of vegetable fat replacers is applied in the British foodlaw and in Poland the certain amount of cocoa butter substitutes was also allowed for chocolate production. In a view of many traditional Belgian chocolatiers who are proud of the excellent quality of their products and closely associate it with the current strict law on chocolate composition, the new regulation may destroy the image of Belgian chocolate.

As it was discussed in the chapter related to the legislation for chocolate, there are basically two approaches to this problem within the European Union. Some countries such as Benelux countries, Germany, France, Spain, Italy and Greece do not allow 5% of vegetable fats in chocolate. On the other hand, there are seven Member States whose national rules permit use of these fats up to 5% of the finished product. These are: Denmark, the UK, Ireland, Portugal, Austria, Finland and Sweden (Feehan, 1996). The sensitive issue at the moment is connected with the question if the European Commission will allow the addition of cocoa butter replacers over the entire EU or not. Related aspects concern labelling of such chocolate, as national laws with regard to labelling differ at the moment.

For instance, in Belgium mandatory message on the label covers only the product name, name and place of production, quantity and lot number. According to the present law the „use-by" date and ingredient list in food products is optional. In spite of this fact, most chocolate manufacturers are prepared for the expected coming change in law and have already introduced many parameters of the label, which could conform to the appropriate Council Directive.

In comparison, Polish foodlaw on the food labelling, dating back to 1994 is more detailed. It generally specifies the name of the product; the name and address of the manufacturer; „best before" date (date of minimum durability); lot number; number of standard to which the product was manufactured; ingredients list; net weight and country of manufacturing. It is worth to noticing, however, that labels of Polish chocolate products do not cover the information on percentage content of

cocoa and milk solids while chocolate labelling manufactured in the EU's countries does (Appendix 1). Moreover, it is observed that the strategy, in this aspect, of foreign companies which operate in the Polish market is as follows: chocolate produced under the original name of the manufacturer has the label with the stated percentage of cocoa or milk solids, while products marketed under the name of the Polish partner of the company do not have such information.

A lot has already been done in reviewing old legislation on chocolate in Poland and other countries of Central and Eastern Europe (CEEC's). Poland is currently in the process of changing and adjusting legislation for chocolate to the EU directives as the model. New regulations for weights and new Polish norms based on ISO standards are being created. The legislation concerning the composition of chocolate allows the producers to act differently and influences higher competition. However, from the consumer point of view it may be a potential threat because if the law is not harmonised chocolate produced in one country with not less then 30% of cocoa solids may be called „Plain Chocolate" while chocolate produced in another country may contain only 25%, as milk chocolate, and also be called the same name.

Let's take an example. The current national foodlaw differs in each Member State. The same may be observed in the CEFTA countries*. If the situation related to the foodlaw harmonisation remains unchanged international manufacturers will continue taking advantage of the country were the legislation is less strict. The Milka produced according to the West European standards will have to contain the minimum 31% of cocoa solids, but Milka which will be manufactured in Poland will not necessarily have the same amount of cocoa solids. This may not only have a strong influence on the sensory characteristics of chocolate but may also change quality and price of these products. Adulterations, substitution of ingredients such as famous rule of 5% of cocoa butter replacers, different legislation in some countries and influence of various processing methods have a paramount influence on the quality of chocolate. As in Belgium, Polish legislation does not allow to use cocoa butter substitutes. Methods of quality assurance differ and the companies do not apply the same instruments even if the methodology is the same.

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*In 1992, Hungary, Czech Republic, Slovakia and Poland signed the Central European Free Trade Agreement (CEFTA). These countries are also called the Visegrad Group countries.

The process of harmonisation of foodlaw in the European Union and CEEC's is still in progress. It is considered that the adjustment of the current law of CEEC's needs a lot of time, financial support and changes in mentality among those responsible for the industry. It does not only relate to the companies operating in the sector but also to the governmental institutions which gather data on production, trade and consumption patterns. These data are highly desired by national and international institutions and might be used for predicting future trends as well as for tailoring marketing strategies in the chocolate sector. However, after privatisation of the confectionery industry in Poland, such data collected by the national statistical institutions are only related to the confectionery production, and there is a lack of them on trade and consumption patterns in the country.

Much has been done in the chocolate industry in Poland since the Second World War. In the period of central planning the food industry operated within the state-owned or 'co-operative' structures. The handicraft and private food industry accounted for approximately 5%. (Rowiñski, 1994). Most of the confectionery companies, initially family-owned businesses, were nationalised, modernised and quite well supported in comparison with other sectors of food industry. The general characteristics of the confectionery industry at the beginning of 1980s are as follows: traditional technology based on small investments and labour-intensive production; small assortment of rather poor quality products; presentation through the package and retail outlets treated as the marginal, unimportant aspect of the whole marketing practices. The tactic of avoiding competition as a result of governmental protection since the nationalisation process was well known. A few competitors were negligible and therefore the consumer products were not diversified and of low quality. The end of 1990s marks the dramatic change in this sector of food industry. The companies have only begun to be truly international groups the range of products offered for a market becomes wide and of better and diversified quality (such as to meet customers' demands), competition takes a natural everyday part in the life of chocolate business and technology is more and more advanced as labour force is

reduced. Many of the enterprises became more independent as the supervisory organs were liquidated. The central planned economy obstructed healthy competition in the country and the majority of supply, even for the domestic market, were not of a desirable quality. The first standards referring to the chocolate industry go back to the end of 1950s. Producing according to the standard, even if it is set up highly seems to be insufficient when there is no real competition and when the continuous improvement, for instance in product image, is not pursued. It must be mentioned here that the high proportion of confectionery products in Poland did not even fulfil the standard requirements.

European confectionery industry was one of the first which recognised the need for mass production and encouraged pure food standards in production. The large manufacturers recognised very soon the need for the mass marketing, such as Cadbury which was one of the first companies to use market research (Nuttall, 1994). The golden rule of marketing formulated by George Cadbury states: „to manufacture a better product than competitors; to distribute it widely; and to advertise it so that people knew it was there" (Nuttall, 1994). While writing these words George Cadbury had only forgotten about the aspect of continuous market research and product re-design according to the changing consumers' demand.

The above presented aspects are well known for the chocolate manufacturers of our times. The strategy of wide distribution has already taken a form of international corporation networks; the competition in product design and manufacture is expressed in the quality control systems which assure the standards set up by consumers, and advertising is now performed in various ways not only by mass approach but also in more sophisticated forms such as individual selling by missionaries, order getters or order takers (Viaene, 1995). It should be noticed that not only these chocolate companies which have strong links with the Western capital understand the need for quality assurance systems such as Hazard Analysis of Critical Control Points or Total Quality Management. However, only those with this strong financial support may afford the quality system. The exemplar Wedel company received ISO 9002 certificate this year and other companies are in the process of reorganisation and preparation of new structures according to the ISO requirements.

Both foreign and Polish chocolate manufacturers are continuously learning how to make good promotion, how to distribute products in the most effective way and how to keep control over the product freshness at the point-of sale. Additionally, quality control during production is of critical importance. Only the richest companies may afford in-line devices for assurance of certain quality parameters during production. These are basically companies with mass-production facilities and high production yields. On the other hand, in some countries, like Belgium, high-quality and high-priced chocolates are made almost in kitchen conditions, often behind a retail shop. The manufacturers of such products do not need sophisticated technologies and in fact their strength lays in the traditional approach to technology which has its reflection in the unique sensory and visual properties of their products. Such firms as Leonidas, Godiva or Wedel (Wedel Cake) would probably find a profitable position in this market if their products fit to the Polish consumers' pocket.

Generally, it may be said that the future of food processing, such as confectionery manufacture, is strongly linked to quality control. It is expected that most companies will soon operate systematic quality control schemes which will be regarded to be of high importance by top management. The requirements of Polish consumers and importers from Western Europe will force companies to apply more advanced systems of food production with the guaranteed quality. Using modern data processing methods it is possible to obtain an integrated picture of all events during the processing at any moment, which may be necessary in case of any defence in a court of justice.

According to the working document of the European Commission the general prospect for the Polish economy is „reasonably optimistic", which is explained as „a rather smooth continuation of the reform process and the continuing confidence of the international financial community" (Froese *et al.*, 1995). The EU is Poland's most important agricultural trading partner, supplying of around 50% of Polish imports and taking approximately 55% of Polish exports in this sector (Froese *et al.*, 1995).

The noticeable revival of Polish-Russian trade since 1990 should also be mentioned. Polish economical and political knowledge about the markets of the former USSR may be beneficial in creating new bridges for future contacts and

development of confectionery trade. Some Polish companies like Wawel have a clear strategy of exportation (at the moment about 25% of total production is sold to the Russian market). Because of the unavailability of precise data on confectionery industry it may only be stated that other CEFTA countries play a minor role in Polish agricultural trade and account for a 4.6% of Polish imports (Froese *et al.*, 1995).

Apart from these prospects for the Polish food and agricultural sector many potential foreign investors are worried by unstable political situation, frequent changes in legal rules which regulate economic activities and deficient economic infrastructure as well as unclear relations within the Polish companies. However, the French (Cacao Barry), Italian (Ferrero), English (Cadbury) and Finish (Fazer) chocolate producers have already found their place in the Polish market. The growing popularity of brand chocolates of the above mentioned companies is currently being observed. Additionally, chocolates which are not produced in Poland -inter alia- brands of Swiss-origin Lindt & Sprüngli and Milka chocolates of Kraft Suchard-Jacobs (imported to Poland from Germany) gained a wide consumer acceptance.

The ownership changes in confectionery industry in Poland had various courses. Privatisation processes were not easy as the traditions of labour management and difficult economic conditions are strictly connected with Polish reality. These two factors are considered to slow down ownership changes in Poland. The „quality of ownership changes" is supposed to open up prospects for any enterprise as well as the improvement in the current financial situation of the Polish partner (Belka *et al.*, 1993). It is not only the liberalisation of trade and many investment activities in Poland but also a significant change in the companies' strategies such as diversification policies that may be observed in the case of Wedel which after merge with Frito-Lay, American chips' producing company, started a new production plant where salty snacks are manufactured.

The situation of chocolate industry in Western Europe seems to be different. Firstly, due to the excellent traditions of chocolate making technology i.e. close contacts with the suppliers of the cocoa beans and the developed market rules which regulate competition, the chocolate production in the EU countries is highly established and cushioned. Although chocolate products consumption has been

generally increasing in recent years, going up to almost 10 kg per capita for Switzerland in 1991, it may be noticed that this market is going to reach the saturation level and the consumption dropped slightly during the last few years. Figures from 1994 showing the decrease in chocolate consumption led the major companies to pay increasing attention to export markets. It is projected that export sales should grow much faster than home market sales. This trend has good prospects as all of the main chocolate manufacturers e.g. Belgian or English belong to the international groups.

Additionally, it may be noticed that the location of the production facilities of major manufacturers in Europe gives valuable access to the European mass market. For instance, the strength of the Belgian praline sector is related to the latest trend „less quantity in favour of more quality" and is supposed to continue. The recent market analysis revealed the increasing demand for chocolate-coated biscuits and chocolate-coated ice cream products so, it may be a new fresh start of the domestic consumption in the Western Europe. High expectations are also linked to the increased snacking activity, especially among the youngsters; development of the gift and the occasion market; increased multiple grocers' share and the presentation of courtliness in multipacks. Being in the Single European Market means also favourisation of multinational suppliers and therefore, such Continental players as Nestlé, Suchard-Jacobs and Ferrero, which represent the best marketing skills in Europe, contribute to the fair prospects for the continuous development of chocolate confectionery industry.

Finally, something should be said about the possible advantages that all nations may take from the common economic market. A few years before the creation of the Single Market it was predicted that the increased market integration was estimated to bring about a cost reduction of 1-7 per cent of the costs of one-third of European industry (Rutherford, 1992). The removal of barriers to trade, by the unification or cancelling of remaining differences between the technical regulations of the EU countries brought the liberalisation and a significant impact on trade efficiency, innovation and increased specialisation and reduction of industrial costs within the Union. Custom tariffs differ between the EU and CEEC's. On 1st January 1996 a new custom tariff was introduced in Poland. This tariff is related to the

industrial and agricultural products in the commercial exchange with CEFTA, EFTA and the EU countries. In the EU customs on sweets amount to 25% while the new proposed customs in the Visegrad Group countries should decrease from current 45-30% to 10% for the importation of confectionery products. Therefore, there are many controversial notes on liberalisation of these customs and the loudest protests have been heard from the confectionery manufacturers as they predict unsteadiness of national confectionery market. They also suspect the increased competition, especially from the Czech Republic manufacturers. However, so far it has been almost impossible to buy the Czech chocolate in the shops or even supermarkets.

Practical work done by the author i.e. sensory analysis of chocolates, produced by the main leading Belgian, Polish and English manufacturers, allow to put forward some conclusions and predictions. It must be stressed however, here that these are only conclusions drawn from a small, statistically insignificant, number of panellists so further research would be necessary. The panel of initially 20 people of different age, sex and country of origin (13 countries: Belgium, England, Poland, Nepal, Philippines, India, Tanzania, Zambia, Bolivia, Ecuador, Greece, Hungary and Lithuania) was used for the determination of sensory characteristics of Western and Eastern types of chocolates. The chocolates taken into the evaluation represented: firstly - a typical rich and very smooth chocolate taste of West European chocolates, such as the Callebaut and Côte d'Or products; secondly - mildy and characteristic crumby taste of English chocolates, such as Cadbury and Terry's chocolates; and finally - bitter and hard flavour as well as structure of East European chocolates on the example on Wedel and Wawel companies.

The preferences of the panellists differed, but some trends were noticed. It may be generally said that the citizens of more advanced countries liked the West European taste of chocolate. Those who came from Africa and the Far East preferred the East European taste and those from South America, who are used to more lypolysed flavour of American chocolate, chose both types of chocolates depending on the attribute that was assessed. The chocolates which scored the higher amount of points were those of Côte d'Or, Callebaut and Terry's. Polish chocolates were not accepted especially as far as odour, taste and appearance was concerned. Interesting conclusions can be drawn from the answers of Polish panellists. The preferences

towards a taste to which they have been used for many years, as the market was closed for Western products, is not so clear. While some of them definitely chose taste of Polish chocolates others only indicated the Western products as the most favourable ones.

Taking into consideration all of the above factors and conclusions presented in each chapter it can be stated that the chocolate industry in Western, Central and Eastern Europe is undergoing a noticeable change. This change will be accelerated if the harmonisation of foodlaw continues and its fast enforcement takes a place. This may relate to the uniform rules on the addition of cocoa butters replacers and denomination of such products within the European Union. Many countries do not want to implement stricter rules banning the addition of these fats. Flexibility of recipes and therefore wider possibilities of marketing new products in line with changing consumer expectations is often emphasised by the countries which allow 5% of cocoa butter substitutes.

Much has also been said about the serious consequences for a number of African, Caribbean and Pacific (ACP) countries, the main supplier of cocoa beans to Europe. It was estimated that the extension of the 5% rule across the entire EU would reduce cocoa demand in Europe by between 60,000 and 200,000 tonnes per year, costing the exporting countries up to US$ 880 million (Feehan, 1996). Opponents of the 5% rule stress the EU's moral obligation to the ACP countries that supply the cocoa beans. On the other hand, the representatives of those who have already got acquainted with the high possibilities and profits of using the cocoa butter replacers point out that the introduction of that 5% rule will not be done overnight. Not all products will incorporate vegetable fats other than cocoa butter and the substitution will not be reached up to the level stated.

The officials such as Arnold Van Hecke, Director of CAOBISCO, which represents the European chocolate confectionery industry, stresses that the use of up to 5% non-cocoa vegetable fats will not undermine chocolate quality (Feehan, 1996). However, this should be left to the personal opinion of each consumer who must be well informed by the label on the composition and origin of chocolate products.

8. SUMMARY AND CONCLUSIONS

On the example of chocolate industry in the West and East European conditions, the aspects related to legislation, quality control, strategies of the individual companies and general trends in production, trade and consumption of chocolate, were studied. The legal requirements of West European countries were compared to those in Eastern Europe. Methods of chocolate evaluation and a real quality control examples from two companies Callebaut and Wawel were contrasted. The leading companies in the Belgian, English and Polish confectionery market were presented and their strategies were described. The need for quality control systems was highlighted and it was proved that there is a strong trend in this direction in many confectionery companies. Additionally, the sensory analyses of various types and brands of chocolates were carried out and the conclusions on the possible consumer preferences were presented.

The conclusions compiled from this study may be summarised as follows:

- The increase in chocolate consumption has a positive prospects, especially in the countries of Central and Eastern Europe.
- Legislation for chocolate will continuously be watched and presumably changed in accordance with the harmonisation works on the national law in each Member State of the European Union.
- In many aspects, legislation for chocolate in Eastern Europe is different from that in the West European countries. This is reflected in the compositional standards, quality control methods or labelling requirements.
- The comparison of the leading companies which operate in the chocolate market, allows to state that almost all of them starting from the family-owned businesses underwent a few ownership changes, in form of mergers or acquisitions or as in Poland nationalisation and then privatisation processes. Therefore, the circumstances and inter-dependence under which these companies exist are complicated and highly diversified.

- The wide understanding of a need for quality control assurance systems is noticed among the chocolate manufacturers and a lot of work done can be observed in this area.
- Sensory attributes of West and East European chocolates are undeniably recognised and defined by the consumers' preferences, which may help producers to tailor global strategies in the chocolate market.
- It was noticed that the majority of citizens of more advanced countries preferred chocolates of the Western manufacturers. Panellists who came from the Far East and Eastern Europe liked the chocolates of the East European origin and those from the American continent chose both types of chocolates.
- Independently of age, sex and country of origin of the assessors, the best chocolates in the milk category were those of Callebaut and Côte d'Or as well as Terry's. Plain chocolate of Callebaut and Côte d'Or gained the highest amount of total points. The same relation was observed for milk chocolate with hazelnuts.

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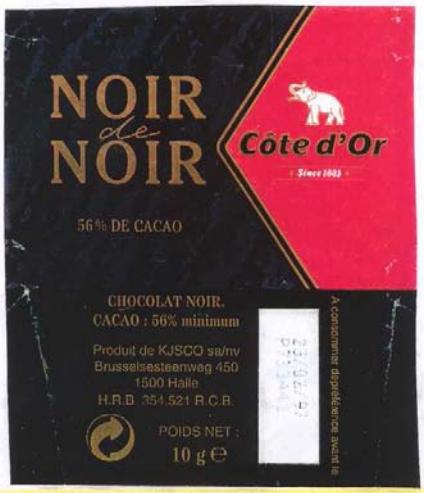
Examples of labels of Belgian and Polish chocolate brands

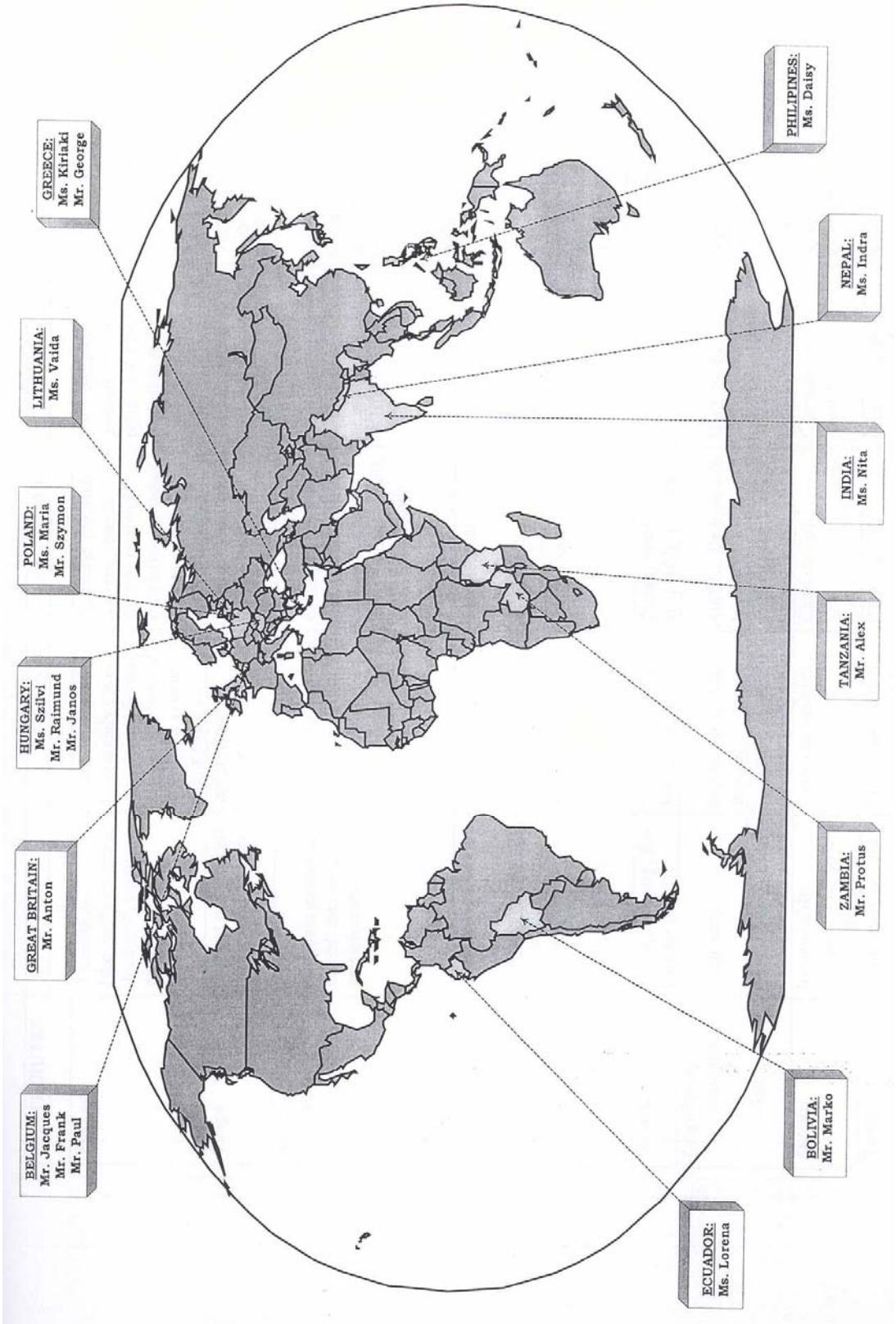


→ • **Côte d'Or**
Dark chocolate

→ • **Callebaut**
White chocolate

→ • **Wedel**
Light milk chocolate

→ • **Wawel**
Full milk chocolate


GREECE:
Ms. Kiriaki
Mr. George
LITHUANIA:
Ms. Vaida
POLAND:
Ms. Maria
Mr. Szymon
HUNGARY:
Ms. Szilvi
Mr. Raimund
Mr. Janos
GREAT BRITAIN:
Mr. Anton
BELGIUM:
Mr. Jacques
Mr. Frank
Mr. Paul
PHILIPINES:
Ms. Daisy
NEPAL:
Ms. Indra
INDIA:
Ms. Nita
TANZANIA:
Mr. Alex
ZAMBIA:
Mr. Protus
BOLIVIA:
Mr. Marko
ECUADOR:
Ms. Lorena

SOLID CHOCOLATE -MARK EVALUATION

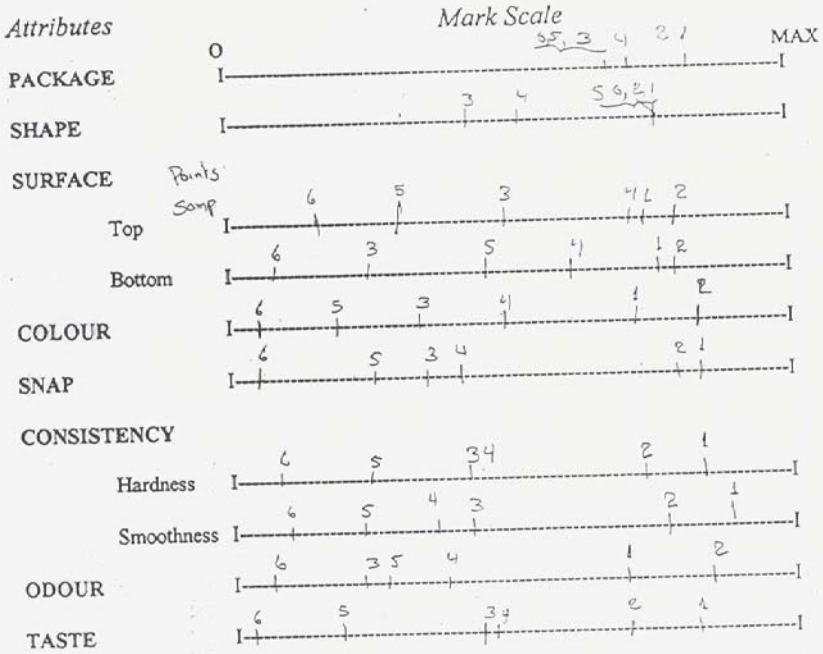
ATTRIBUTES	MARK SCALE				
	0				MAX
Package	Anaesthetic, incorrectly covering, destroyed, paints easily removed	Nearly anaesthetic, inaccurately covering, insignificantly destroyed, traces of greasiness visible, paints removed	Aesthetic, precisely covering, paints slightly removed, insignificant amount of product crumbs inside a package	Very aesthetic, precisely covering, paints unrubbed, crumbs present inside a package	Very aesthetic, very precisely covering, paints unrubbed, crumbs absent
Shape	Distinct deformation, mechanical damage	Insignificant deformation, slight breakage	Regular shape, edges brittled very insignificantly	Regular, without damages and breakages	Very regular, without damages and breakages
Surface					
-Top	Indistinct pattern of mould, mat with greyish spots	Uneven, not distinct pattern of mould, spots without gloss, many holes	Glittering, smooth, with distinct pattern of mould, a few holes, in case of milk chocolate-slightly mat	Very glossy, smooth, with distinct pattern of mould	Significantly (eye-catching) glossy, very smooth, with very distinct pattern of mould, without traces of damages and greyness
-Bottom	Very uneven, many pores, stains and greyness	Uneven, not many pores, slightly greyish spots	Smooth, mat	Smooth, mat	Very smooth, mat
Colour	Improper, unclear, grey shadow	Not all proper, uneven, distinct shades	Proper, shades very insignificant	Proper, clean, even	Very proper, clean, significantly even, dark brown-for plain, light brown-for milk chocolates.
Breach	Improper, peaty, air-bubbles present	Not proper, tiny air-bubbles present	Proper, even, single air-bubble allowed	Mat, even, proper	Very proper, mat, even
Consistency					
-Hardness	Little hard	Not all hard, little brittled	Sufficiently hard and brittle	Hard, brittle	Significantly hard, brittle
-Smoothness	Coarse, waxy, slimy	Sensation of articles	Sufficiently smooth	Smooth	Very smooth, creamy
Odour	Incompletely characteristic, little sour, strange	Little characteristic	Characteristic	Characteristic, aromatic	Very characteristic, fully aromatic
Taste	Little improper, not aromatic, sour notes	Little characteristic, not harmonised, little sour	Characteristic	Characteristic, aromatic	Very characteristic, harmonised, fully aromatic

Package 6 → only show nuts, no chocolate
5 → I can suppose something of chocolate
3 → by milk also, I suppose chocolate
2 → I can recognized chocolate

Age: ____
Sex: F
Country: Ecuador
Plate no: 18

Product: **MILK CHOCOLATE WITH HAZELNUTS**

Please evaluate each sample, according to the 8 attributes given below, by marking a number of sample on a Mark Scale.
See Tab.1 where you can find an explanation of Mark Scale.



Comments (if any)

Samp

6 nuts almost nothing, few amount not taste
– handling easier — most were melted

1 → nuts very good
handling: it is easier melted

2 → nuts uniform distributed but with colours different and not clear taste
handling easy melting

3 → nuts only one, a little bit sour
handling ess.

you see

4 → nuts good taste
handling not melted

5 → nut very pale, not clear taste
handling melting easy

PLEASE note your comments as: - quality of hazelnuts,
- handling characteristics
for each of presented chocolates

Preference Testing : HEDONIC SCALE

Age: 24
Sex: F
Country: GREECE

Plate no: 11

Product: **MILK CHOCOLATE**

Please evaluate each sample in the order given and tick the term which best describes how much you like or dislike that particular sample.

No.	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
☺ **Like Extremely**	X					
Like Very Much						
Like Moderately						
Like Slightly					X	
😐 Neither Like nor Dislike						
Dislike Slightly						
Dislike Moderately				X		
Dislike Very Much		X	X			X
☹ **Dislike Extremely**						
COMMENTS (if any)	Very full taste physical without peculiar odour	Stange too strong odour for a chocolate	Fully taste but the odour is too milky.	At the end gives a sauer taste and the odour like n. 5	Strange odour doesn't remind me chocolate	Strange odour and the taste is very low

Please answer the following questions:

	Yes	No
1. Do you smoke?	—	X
2. Do you suffer the illness like:		
- allergy?	—	X
- temporary cold?	—	X
3. Are you tired?	X	—

4. Which kind & brand of chocolate do you usually buy? Côte d'or, Milka

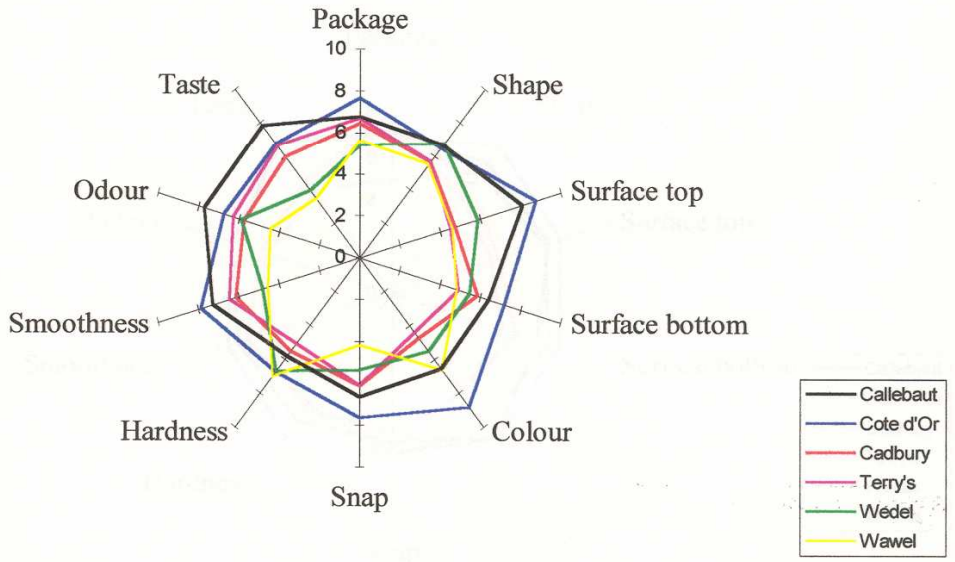
— — — — —

ATTRIBUTE TEST

Average values given to sensory attributes of MILK CHOCOLATE of 6 brands

Attribute	*Brands*					
	Callebaut	Cote d'Or	Cadbury	Terry's	Wedel	Wawel
Package	6,77	7,68	6,44	6,69	5,41	5,63
Shape	6,68	6,50	5,68	5,71	6,75	5,51
Surface top	8,08	8,77	4,73	4,52	5,86	4,61
Surface bottom	6,43	7,20	5,89	4,94	5,49	4,84
Colour	6,58	8,83	4,77	4,45	5,57	6,64
Snap	6,66	7,64	6,14	6,11	5,37	4,19
Hardness	5,81	6,74	5,54	5,06	6,72	7,01
Smoothness	7,28	7,86	6,14	6,46	4,83	4,55
Odour	7,73	6,75	5,73	6,27	5,87	4,43
Taste	7,82	6,75	5,95	6,63	3,96	3,47

Comparison of sensory attributes of MILK CHOCOLATES produced by the six companies (10-point scale indicates ranking of analysed brands)

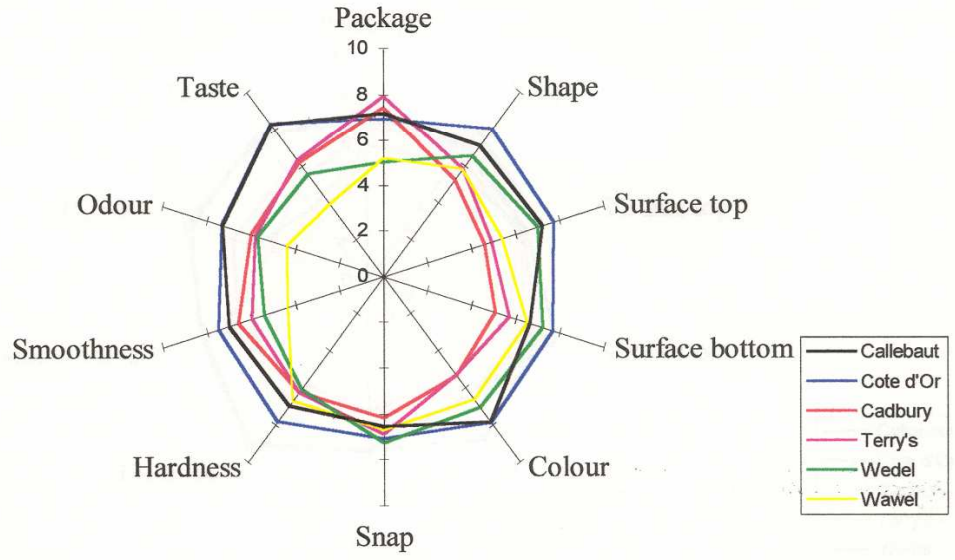


ATTRIBUTE TEST

Average values given to sensory attributes of PLAIN CHOCOLATE of 6 brands

Attribute	*Brands*					
	Callebaut	Cote d'Or	Cadbury	Terry's	Wedel	Wawel
Package	7,14	6,91	7,39	7,91	5,01	5,18
Shape	7,06	8,00	5,24	5,83	6,51	5,81
Surface top	7,21	7,73	4,59	4,92	7,03	5,37
Surface bottom	6,64	7,68	5,07	5,71	7,21	6,51
Colour	7,84	7,86	5,33	5,30	7,04	6,62
Snap	6,54	7,08	6,16	6,88	7,26	6,69
Hardness	6,96	7,81	6,21	6,24	6,07	6,68
Smoothness	7,01	7,49	6,58	5,98	5,40	4,34
Odour	7,30	7,32	6,00	5,81	5,70	4,40
Taste	8,23	8,25	6,18	6,31	5,56	3,95

Comparison of sensory attributes of PLAIN CHOCOLATES produced by the six companies (10-point scale indicates ranking of analysed brands)

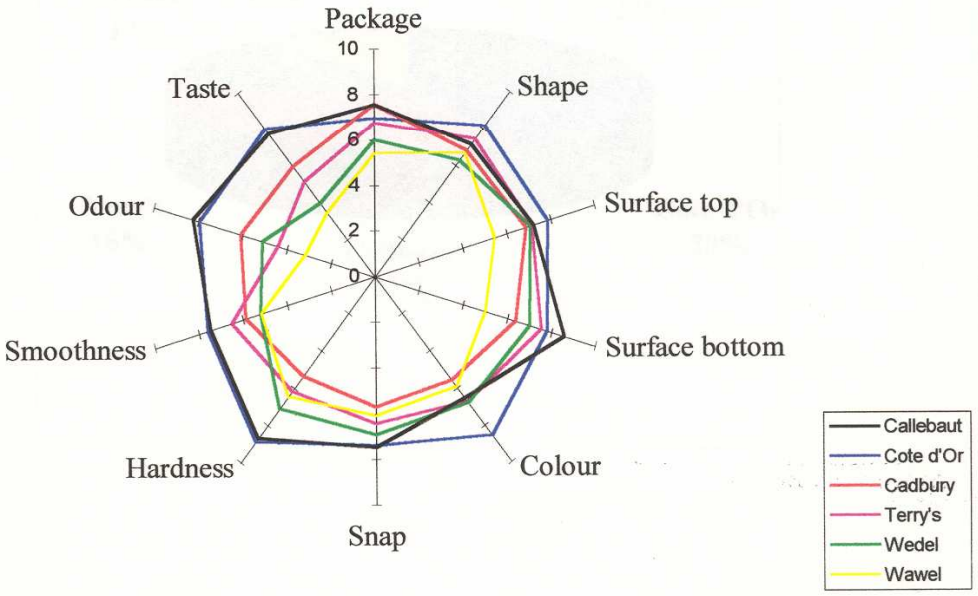


ATTRIBUTE TEST

Average values given to sensory attributes of MILK CHOCOLATE with HAZELNUTS of 6 brands

Attribute	*Brands*					
	Callebaut	Cote d'Or	Cadbury	Terry's	Wedel	Wawel
Package	7,55	6,95	7,58	6,75	6,01	5,42
Shape	7,16	8,17	6,81	7,44	6,27	6,68
Surface top	7,23	7,87	6,89	7,16	7,09	5,48
Surface bottom	8,62	7,82	6,38	7,56	7,04	5,01
Colour	6,55	8,59	5,60	6,76	6,82	5,94
Snap	7,46	7,38	5,69	6,44	6,90	6,08
Hardness	8,70	8,88	5,33	6,18	7,10	6,46
Smoothness	7,46	7,63	5,88	6,53	5,22	5,19
Odour	8,25	7,95	6,11	4,40	5,11	3,17
Taste	7,79	8,05	5,99	5,17	4,01	3,50

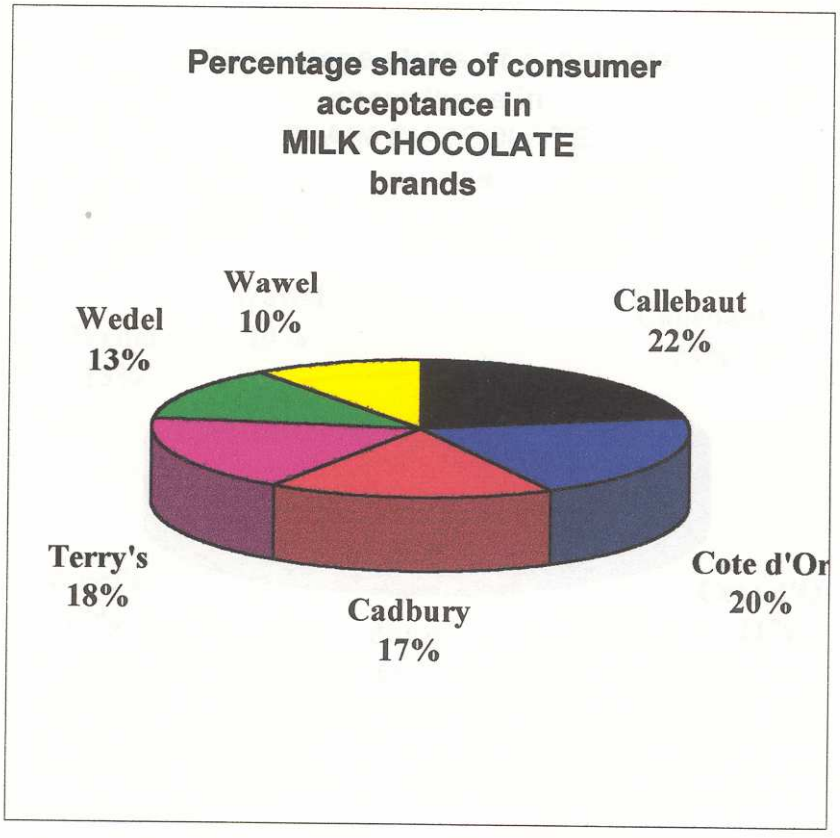
Comparison of sensory attributes of MILK CHOCOLATE with HAZELNUTS produced by the six companies (10-point scale indicates ranking of analysed brands)



HEDONIC SCALE TEST

Average values given to MILK CHOCOLATE of 6 brands by different assessors

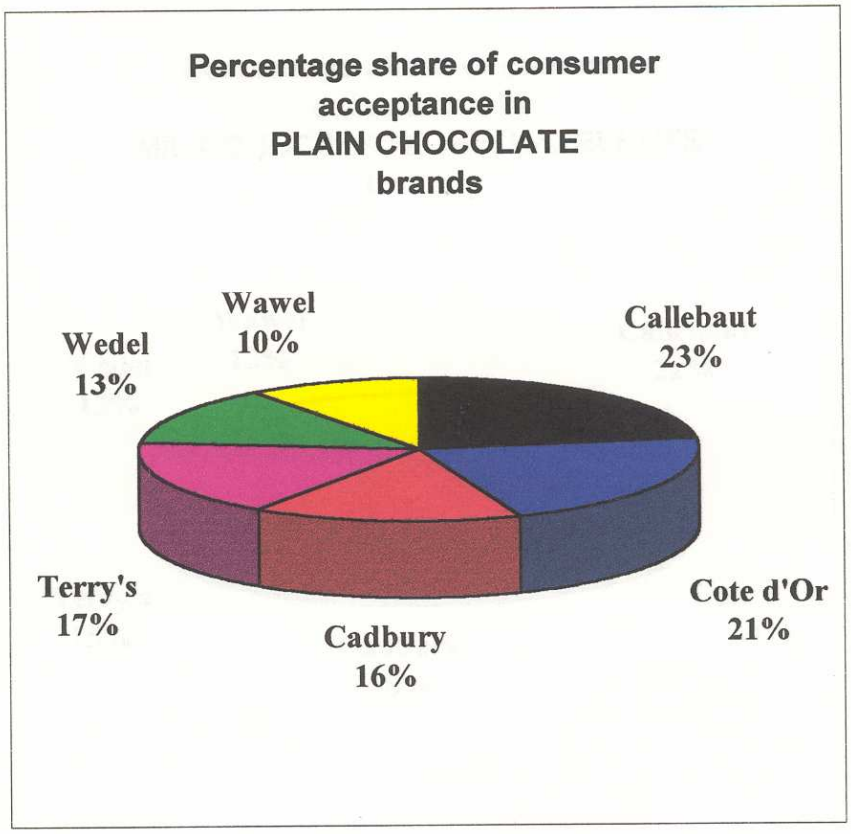
	Number	1	2	3	4	5	6	7	8	9	10
Assessor data	Country	B	UK	HUN	HUN	GR	LITH	ECU	BOL	IND	PHIL
	Age	27	24	25	24	24	26	31	25	24	29
	Sex	M	M	M	M	F	F	F	M	F	F
Brand	Callebaut	7	7	8	7	9	9	7	8	8	6
	Cote d'Or	9	9	8	8	2	7	8	8	6	7
	Cadbury	5	8	7	8	2	4	6	7	7	6
	Terry's	5	7	6	8	3	7	8	6	8	5
	Wedel	1	3	7	6	6	5	5	3	4	5
	Wawel	2	2	5	3	2	5	2	3	6	6



HEDONIC SCALE TEST

Average values given to PLAIN CHOCOLATE of 6 brands by different assessors

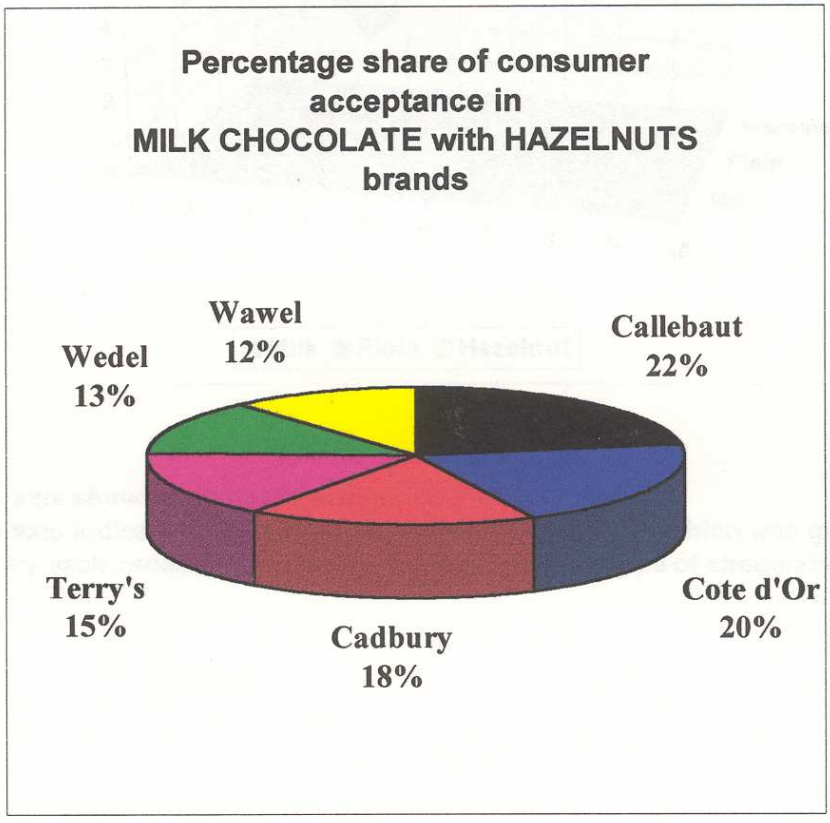
	Number	1	2	3	4	5	6	7	8	9	10
Assessor data	Country	B	UK	HUN	HUN	GR	LITH	ECU	BOL	IND	PHIL
	Age	27	24	25	24	24	26	31	25	24	29
	Sex	M	M	M	M	F	F	F	M	F	F
Brand	Callebaut	9	4	7	5	9	9	7	7	8	8
	Cote d'Or	8	5	6	4	9	9	7	8	4	9
	Cadbury	1	5	5	6	2	7	3	8	7	6
	Terry's	2	2	5	5	4	8	8	6	9	6
	Wedel	1	3	5	2	6	7	2	5	4	7
	Wawel	1	5	5	1	3	4	1	3	3	6



HEDONIC SCALE TEST

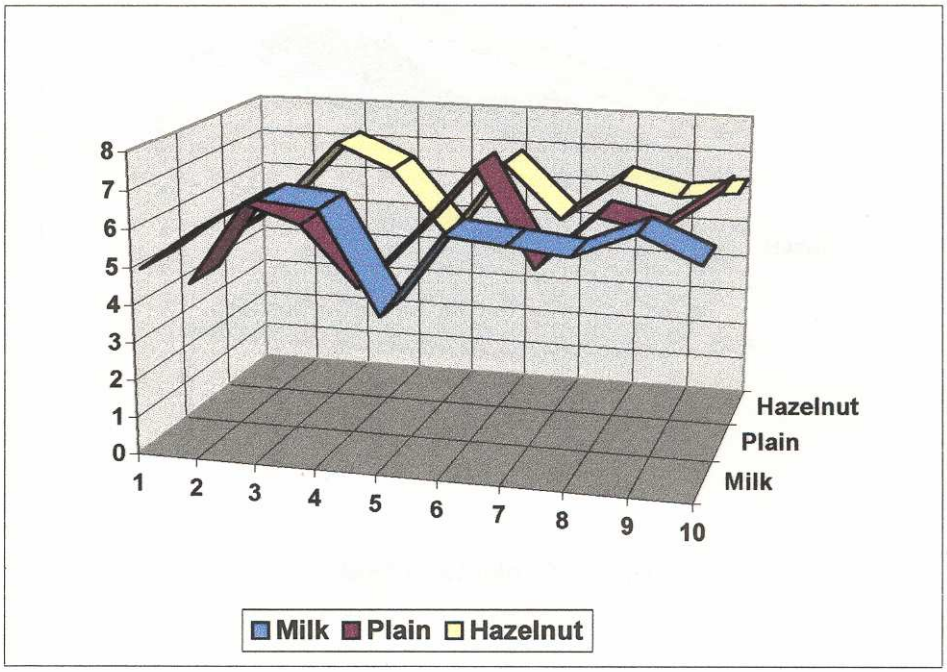
Average values given to MILK CHOCOLATE with HAZELNUTS of 6 brands by different assessors

	Number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Assessor	Country	*B*	*UK*	*HUN*	*HUN*	*GR*	*LITH*	*ECU*	*BOL*	*IND*	*PHIL*
data	Age	*27*	*24*	*25*	*24*	*24*	*26*	*31*	*25*	*24*	*29*
	Sex	*M*	*M*	*M*	*M*	*F*	*F*	*F*	*M*	*F*	*F*
Brand	Callebaut	8	6	8	9	9	9	8	8	8	7
	Cote d'Or	9	8	8	7	8	7	7	7	4	7
	Cadbury	3	7	7	9	4	6	5	8	8	6
	Terry's	4	4	7	6	3	8	6	7	4	6
	Wedel	1	2	7	5	2	5	5	5	7	6
	Wawel	1	6	6	3	2	6	1	4	6	6



ASSESSORS' PREFERENCES

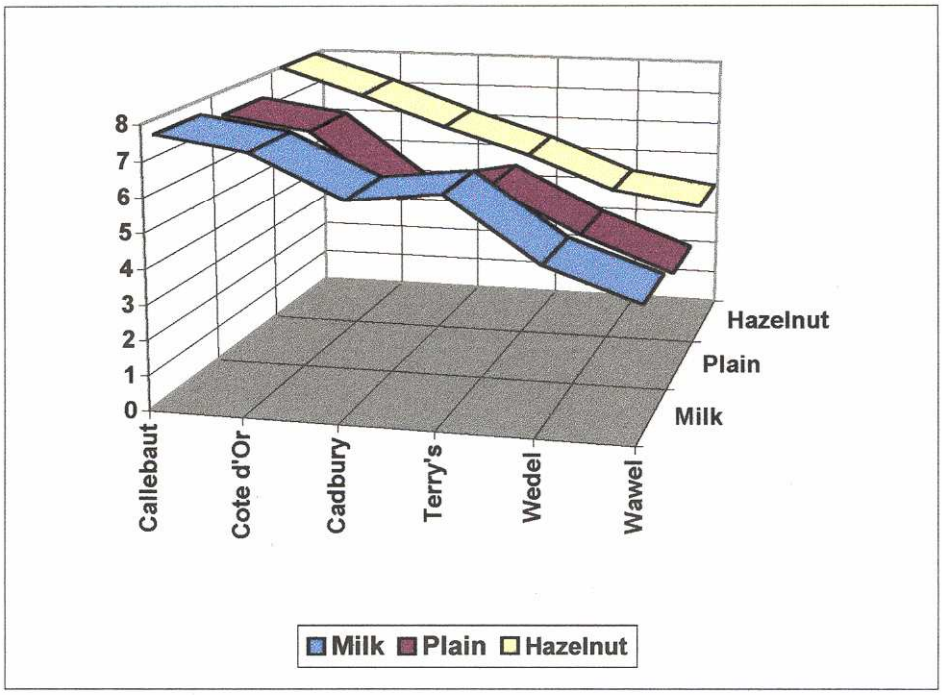
for milk, plain and milk with hazelnuts chocolate



X - axis shows the consequent number of assessor
Y - axis indicates the average value, in 10-point scale, which was given by each assessor to all brands within a certain type of chocolate

PREFERENCE INDICATIONS

for milk, plain and milk with hazelnuts chocolate of 6 brands



X - axis shows the brand names of the evaluated chocolate bars
Y - axis indicates the average value, in 10-point scale, which was given by all assessors to each brand within a certain type of chocolate