Cigar Box
Improvement System

GLOBAL
facts

MANUAL FOR USING THE CIGAR BOX®

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Introduction

This Manual has been prepared in the context of the training of Small and Medium Agro-in Processing Enterprises and National Consultants in Tajikistan in 2009. The training was conducted as part of the FAO/EBRD/BAS project aimed at strengthening advisory services to agri-business SMEs in Tajikistan. Six processing companies (3 Dairy and 3 Fruit and Vegetable Processors) participated during two training periods of 10 days each in April and July 09, respectively and are implementing CB 2 and 3. The Manual is geared at supporting companies in the implementation of Cigar Box and to serve as reference for national consultants in backstopping companies or helping other companies in introducing the Cigar Box system.

The Manual is work in progress and will be updated and improved based on implementation experiences and feedback from users. Any suggestions for this purpose are highly appreciated and can be sent:

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Contents

List of figures

List of tables

Chapter 1 Overview of the Cigar Box® Improvement System

The Cigar Box® system …

…consists of 4 modules.

CB1. Cost Price Calculation → Break even analysis	Know your full cost price and sales targets
CB2. Contribution calculation → Portfolio analysis	Know your full assortment at SKU level
CB3. Operational monitoring → Evaluate progress	Know your daily losses and contribution
CB4. Investment analysis → Make a business plan	Know your payback period and IRR

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History: The Dutch pioneers who went to Indonesia in the 17th Century were real adventurers: they started coffee, tea and rubber plantations in jungles which before where never used for agriculture. Fit gentleman in their late twenties, usually from middle class families, undertook the long journey by sailing boat to Batavia. They used family capital to start the plantation. After 5 years the plantations started to bear fruit and the first shipments of precious coffee, tea or spices were sent back to Amsterdam. The young pioneers usually ran out of money soon and they returned to Holland to find fresh (ad)venture capital. The young men would put on their nicest clothes and high hat. They would enter a 'coffee house' and hoped to be invited on a table with successful business men and would offer them a cigar. Sipping coffee, smoking a cigar, they hoped to be allowed to explain why they needed more money. Much time was not given. They had to explain in a simple, concise a convincing manner. They would take the box of cigars, turn it around and write essential figures on the backside: size of the plantation, number of tea plants, investment per hectare, years to maturity and the expected first yield, the quality and the price. Finally, they indicated profitability and a proposal how to share it with his investors. Within 15 minutes the Cigar Box deal was done: or not done..!

Today, the Cigar Box is still alive but makes use of the benefits of modern technology. The virtual Cigar Box is a simple Excel Spreadsheet model which can help company owners, managers and possible financiers to assess and monitor key performance indicators. It is a cost accounting system and as such complementary to the bookkeeping system. Where a bookkeeping system registers costs per time (weekly, monthly, quarterly, yearly reports) the Cigar Box reports per product. The bookkeeping system can say that in week 45 a loss was made. The Cigar Box system tells that in week 45 products X and Y had high raw material cost and that their gross margins were negative and therefore a loss was made. Normally, a company uses both systems.

The Cigar Box Suite consists of 4 modules which are complementary:

CB1. **Cigar Box® Cost Price Calculation** is a simple and accurate system to calculate the cost price, gross margin, contribution and break even point of a single product.

CB2. **Cigar Box® Portfolio Analysis** helps to understand the strength and weaknesses of the product portfolio at SKU[1] level. CB2 calculates cost price, gross margin and contribution for a range of products.

CB3. **Cigar Box® Operational Monitoring System** helps to change your way of working and make more profit. It is used for daily calculation of the cost price, gross margin and contribution of a range of products.

[1] Stock Keeping Unit

CB4. **Cigar Box® Investment Analysis** creates the basic financial tables to make an investment decision and calculates if you can obtain a loan or not. CB 4 assumes that you know the cost price, gross margin and contribution of all your products. CB4 is not explained in this manual.

Chapter 2 Application of Cigar Box 1, 2 and 3

2.1 What Cigar Box does for you (and what it does not do)

All production companies generate data every day. Unfortunately most of these data are not (systematically) analyzed and will thus not lead to a better understanding of what is going on. The only information which is systematically entered into a computer is bookkeeping data and of course information related to sales and procurement; to debtors and creditors. Most of the data required for Cigar Box is already being collected in most factories hence extra work needed for data collection is minimal. Only in a few cases, additional data collection forms must be introduced. Cigar Box help to rationalize data collection in a systematic way and analyze the data collected for operational monitoring as well a for strategic management decisions. Only key data needed for analytical purposes are extracted from existing company reporting and entered in Cigar Box forms (hard copy and computer). Eventually, the company may to only use Cigar Box forms for reporting.

The Cigar Box helps to create **KNOWLEDGE** from data generated in the factory. It is a simple calculation tool in Excel which most people can handle. The Cigar Box:

First, calculates your cost of goods, and
secondly compares this information with industry **benchmarks**. Are we better? Are we average? Are we worse?

The Cigar Box signals:

Red light: problem!
Orange light: warning…
Green light: we are OK!

The Cigar Box does not find underlying causes or offer solutions. This is the terrain of subject matter specialists. These specialist, however, will be very happy, if a systematic collection and analysis of data takes place, so they can trace back to the origin of the problems and efficiently help to overcome them.

2.2 Performance improvement cycle

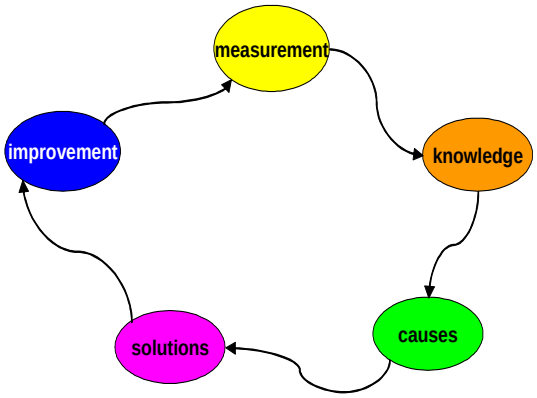
The Cigar Box® Improvement System is designed to help small and medium enterprises to improve performance: better quality, lower cost, more volumes, more profit! All companies try to achieve this. But performance improvement does not come automatically. Experience has shown that the best performing companies **improve themselves**.

Performance improvement comes in steps, in cycles:

1. **Measure** what is going on in your factory:
    a. How much steam did we use on Thursday?
    b. How many cutting losses did we have in the evening shift?
2. The measurement data must be used to create information and **knowledge**:

   a. What is going right?
   b. What is going wrong?
3. The next step is to find out why a process is going wrong? What are the **causes**?
   a. Systematic errors in recipes or procedures?
   b. Human mistakes?
4. If the causes are known, **solutions** can be searched:
   a. Inside the company
   b. Outside the company from expert consultants
5. If a solution has been found, it must be implemented to cause **improvement**. Through continuous measurement, the improvement will be registered; a new performance improvement cycle has started!

Figure 1 – Performance Improvement Cycle



Cigar Box helps companies in steps 1 (especially CB 3 for monitoring) and 2 (monitoring key performance indicators against benchmarks). Steps 3 – 5 in the performance improvement cycle require technical expertise in key subject affecting production process. Cigar Box helps to flag issues, model alternative scenarios based on the real company situation and hence facilitates steps 3 -5.

2.3 Benchmarks

This section provides a brief introduction into the concept of benchmarks which can be used to monitor company performance. Based on data collected with CB 3 over a period of at least two months, benchmarks for Key Performance Indicators (KPIs) can be established against which actual performance is to be measured. For KPI, three performance ranges can be established:

1) Desirable (green),
2) Acceptable (orange), and
3) Unacceptable (red).

Four types of benchmarks exist:

1. The more, the better
2. The fewer, the better
3. The closer, the better
4. The closer, the more likely

EXAMPLE 1 – The More the Better

The higher your margin the better it is. For agro-food processing companies an international benchmark exists which can help the company to evaluate own gross margins:

Gross margin as % of sales	Level	Comment
<15%	Very risky	Only acceptable when the production process parameters and all prices are fully under control.
15-25%	Risky	Only acceptable if production and price fluctuations are within 5-10% range.
25-35%	Normal	
35-45%	Robust	
>45%	Very robust	

EXAMPLE 2 – The Fewer the Better

The fewer apples are needed to produce a kg of Apple Juice Concentrate (AJC) of 68% brix, the better it is.

Kg apples per kg of AJC 68 brix	Level	Comment
< 7 kg	Very good	Use of enzymes; good margins ensured
8 – 7 kg	Normal	Good equipment; resonable margins
9 – 8 kg	Too high	Change equipment and technology as soon as possible; possible losses
> 9 kg	Unacceptable	Stop production; change equipment and technology; sure losses

EXAMPLE 4 – The Closer the More Likely

All production technologies have specific cost structures. Say, the cost of utilities in tomato paste production is usually between 10-15% of the total variable costs. If a processor comes with a figure of 3% it is not likely that it is right and needs to be verified carefully.

EXAMPLE 3 – The Closer the Better

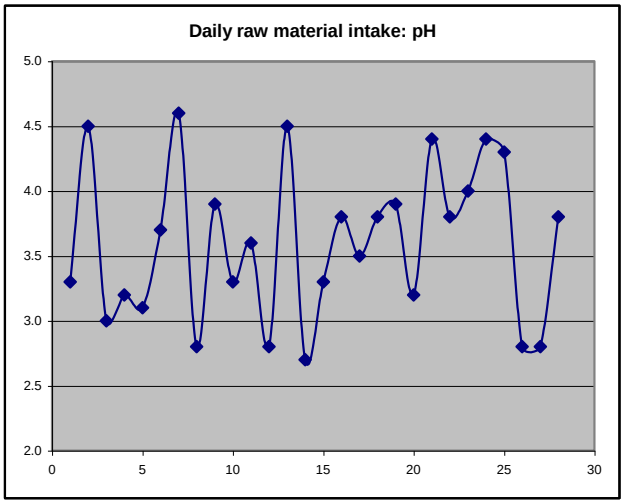
The pH of incoming raw material must be as close as possible to pH = 3.6. Neither too high, nor too low pH is acceptable.

pH of incoming raw material	Level	Comment
< 2.8	unacceptable	Raw material cannot be used for fresh produce
2.9 – 3.3	Bad	Max. 20% of deliveries
3.4 – 3.9	Good	
4.0 – 4.4	Bad	Max 20% of deliveries
> 4.5	unacceptable	Raw material cannot be used for fresh produce

Figure 2 - Monitoring the pH during raw material intake:

SORTED BY DATE

Batch	Date	pH
1	31.12.08.	3.3
2	31.12.08.	4.5
3	01.01.09.	3.0
4	01.01.09.	3.2
5	01.01.09.	3.1
6	01.01.09.	3.7
7	02.01.09.	4.6
8	02.01.09.	2.8
9	02.01.09.	3.9
10	02.01.09.	3.3
11	03.01.09.	3.6
12	03.01.09.	2.8
13	03.01.09.	4.5
14	03.01.09.	2.7
15	04.01.09.	3.3
16	04.01.09.	3.8
17	04.01.09.	3.5
18	04.01.09.	3.8
19	05.01.09.	3.9
20	05.01.09.	3.2
21	05.01.09.	4.4
22	05.01.09.	3.8
23	06.01.09.	4.0
24	06.01.09.	4.4
25	06.01.09.	4.3
26	06.01.09.	2.8
27	07.01.09.	2.8
28	07.01.09.	3.8



Average	**3.6**
Standard deviation	0.6
Red light -10%	2.8
Red light +10%	4.5

red lights	8	29%
orange lights	11	39%
green lights	9	32%
total measurements	28	100%

SORTED BY pH

Batch	Date	pH
14	03.01.09.	2.7
8	02.01.09.	2.8
12	03.01.09.	2.8
26	06.01.09.	2.8
27	07.01.09.	2.8
3	01.01.09.	3.0
5	01.01.09.	3.1
4	01.01.09.	3.2
20	05.01.09.	3.2
1	31.12.08.	3.3
10	02.01.09.	3.3
15	04.01.09.	3.3
17	04.01.09.	3.5
11	03.01.09.	3.6
6	01.01.09.	3.7
16	04.01.09.	3.8
18	04.01.09.	3.8
22	05.01.09.	3.8
28	07.01.09.	3.8
9	02.01.09.	3.9
19	05.01.09.	3.9
23	06.01.09.	4.0
25	06.01.09.	4.3
21	05.01.09.	4.4
24	06.01.09.	4.4
2	31.12.08.	4.5
13	03.01.09.	4.5
7	02.01.09.	4.6

CONCLUSION: raw material procurement must improve drastically!!

Chapter 3 CB 1 Cost Price Calculation

CB1 is to be used to calculate cost price, gross margin and contribution of a single product.

SHORT OVERVIEW OF THE STEPS TO IMPLEMENT

- Understand the **basic production process**, prepare a simple flow chart.

- **Calculate** sales price, variable and fixed costs :
  - P_{EXW} Sales price ex works
  - P_{RM} Purchase price of raw material
  - VC1 Variable cost of raw material and ingredients
  - VC2 Variable cost of processing raw material into the finished product
  - VC3 Variable cost of packaging the finished product
  - FC1 Fixed cost of depreciation of equipment, machinery and buildings
  - FC2 Fixed cost of lending, interest, bank charges
  - FC3 Fixed cost of overhead, salaries, taxes, marketing, maintenance

- Enter **cost data** in the Excel sheets of the Cigar Box®
  - Enter variable cost data: one product, one sheet
  - Enter fixed cost data in separate sheet
  - Agree on fixed cost attribution method

- Review **gross margin** and gross margin %

- Calculate **break-even volume** of sales and raw material needed
  - Review the break-even volume needed and compare with sales contracts / planning
  - Review the raw material required and compare with the purchase contracts/ planning

- Calculate **contribution** and **profit**
  - Enter the volume sold per year
  - Review the contribution and compare this with fixed costs
  - Review profit and profitability

- Review **capacity utilization**
  - Enter the capacity of the installed equipment in tons per hour
  - Enter the number of hours / shifts worked
  - Enter the length of the production season
  - Review the capacity utilization for the volume sold entered under point 6.

3.1 Basic Production Process

To make sure that ALL COSTS are taken into consideration, it is important to understand the basic production process. A simple flow chart, made by a technologist, or downloaded from internet, will do at this stage:

Tomato reception → washing → grinding → hot break → sieving/refining → evaporation → filling → pasteurization in autoclave → labeling → storing

Example of a Cigar Box

CIGAR BOX 1 - Tomato paste 25 Brix, aseptic bags of 220 kg in steel drums					
	USD per ton			**USD per year**	
Price (DDP Moscow)	1,000		Total Revenue	2,721,600	
Import duties, 10%	100		Total Cost	2,511,044	
Transport, sales commission 3%	144		**Profit Before Tax**	**210,556**	
Price (EXW)	**756**		Profitability %	8%	
Price (RM, delivered factory)	71		Asset value	1,800,000	
Processing ratio	6.0		Depreciation %	7.8%	
Raw Material cost	429	*71%*	**FC1**	**140,000**	*41%*
Other ingredients	12	*2%*			
VC1	**441**	*73%*	Debt (40% of Asset value)	720,000	
			Interest rate	18.7%	
Production cost per hour (steam, electricity)	124		**FC2**	**134,400**	*39%*
Production volume per hour (ton/hour)	2				
VC2	**62**	*10%*	Number of FTE employed	15	
			Salaries staff incl. social taxes	50,000	*15%*
			Other overhead, repairs, maintenance	20,000	*6%*
Cost of packing (aseptic bag, drum)	21.8		**FC3**	**70,000**	*20%*
Number of drums per ton	4.5				
VC3	**99**	*16%*	**FC**	**344,400**	*100%*
			FC % attributed to product	100.0%	
VC	**602**	*100%*	**FC (attributed to product)**	**344,400**	
Gross margin	**154**		Volume sold q (ton)	3,600	
Gross margin %	20%		**Contribution**	**554,956**	
			Break even volume (sales)	**2,234**	
Fixed Cost / q	**96**	*14%*	Break even volume (raw material)	21,600	
Total Cost / q	**698**	*100%*	Input capacity per hour in ton	12.0	
			Working hours per day	22	
Profit / q	**58**		Length of harvesting season in days	110	
			Max. input capacity per year	**29,040**	
			Capacity utilization %	74.4%	
*Note: figures in **blue** are assumptions; figures in **pink** are calculated in another sheet; figures in **black** are formulas*					

In the following paragraph all blue and pink figures inside a box have to be filled in. All other figures are formulas calculated by Excel.

3.2 Calculate Sales Price, Variable and Fixed Costs

1. Sales price, P.

The Cigar Box calculates the EXW price of a product. It is net of VAT, import duties, transport cost and sales commissions.

	USD per ton
Price (DDP Moscow)	1,000
Import duties, 10%	100
Transport, sales commission 3%	144
Price (EXW)	**756**

2. Variable cost, VC.

The Cigar Box distinguishes three types of variable cost

- VC1, cost of everything which is consumed: raw material and ingredients
- VC2, cost of processing raw material into the finished product: energy, steam, variable labor, detergents, diesel, gas
- VC3, cost of primary (jar, cap, label) and secondary (carton box, shrink wrap, pallet) packing material.

The % of VC1, VC2 and VC3 in the cost price of the product is a very useful benchmark to analyze the efficiency of a factory. They are now further elaborated:

1. **VC1 is the cost of raw material and the ingredients** (sugar, salt, oil, etc) in the final product. The composition of VC1 depends upon the recipe determined by a food technologist in the factory and it is usually checked by the chief laborant. This is standard procedure. The main cost component is of course the raw material: the apple in the apple juice, the cucumber in the pickled marinat.

Price (Raw Material, delivered factory)	71	
Processing ratio	6.0	
Raw Material cost	429	*71%*
Other ingredients	12	*2%*
VC1	**441**	*73%*

The cost of the raw material in the final product depends on three items:

i. The general market price of the raw material, P (Raw Material, delivered factory). Between years and regions, the price of fruit and vegetables will fluctuate. But more important is the fluctuation within the season. Before the harvest the price is very high, then it drops severely at the peak of the harvest and then climbs up again as the raw material gets scarce. A fluctuation of 100% around the season's average is normal. It is obvious that to be successful in such a volatile market, good fruit procurement is making or breaking.

ii. The quality grade of the specific batch delivered. Two main aspects:
   1. External/visual quality. The outer appearance of both fruits and vegetables is notably important for fresh market products. Color, size, absence of off-smell and damages make a product more valuable.
   2. Internal/intrinsic quality. Every agricultural product has a specific component that makes it valuable for the processor: oil in sunflower, fat in milk. In fruit, the important component is sugar. This is measured with a (handheld) Refractometer and displayed in degrees Brix (breaking index). The higher the Brix, the more valuable the fruit.
   3. Fluctuations of quality are caused, in the first place by nature itself, but secondly (and more importantly) by farm management. The more a farmer controls the production parameters: light, water, fertility and pests/diseases, the more uniform the quality and the higher the yield per hectare.
   4. In the AGROPROCESSING sector, many grading/pricing systems exist, but essentially there are three:
      a. First Quality, fresh market, absence of visible defects.
         Price = 100% daily market price;

Harvested volume = 30-50%

b. Second Quality, fresh market, minor defects
Price = 50-80% of First Quality;
Harvested volume = 20-50%

c. Third Quality, industry, not suitable for fresh market
Price = 10-30% of First Quality;
Harvested volume = 20-50%

5. High quality, uniform products are good for the farmer (s/he gets a better price), but this it is not good for processors who depend on large volumes of third grade fruits… One possibility is encouraging contract farming of specific varieties of food processing crops as alternative to relying on surplus production for the fresh market.

iii. PR, the processing ratio, being the kg of raw material needed to produce 1 kg of finished product, depends on external quality, intrinsic quality and processing efficiency (production losses).

1. An apricot has a peel and a pit. This is a natural loss of weight. However, the larger the apricot, the less the % weight of the skin and the pit. So, larger fruit has a lower PR.
2. A clean cucumber, without visible damages will have less, 'cutting losses' and hence a lower PR.
3. A tomato has a natural sugar contents of 4-5% or 4-5 Brix (processing tomatoes as high as 6 Bx). Standard FSU tomato paste has 25 Brix. So, the PR of 5 Bx tomatoes will be 25/5 = 5 + 4% skin/seed losses = 5.2. The PR of 4 Bx tomatoes will be 25/4 = 6.25 + 4% = 6.5! Fruit buyers must always take the PR into consideration when making a procurement offer and adjust the prices to it.

2. **VC2. Processing costs** have long been denied as important. Steam, water, electricity and labor, it was all very cheap. The recent decision by the Kazakh and Uzbek governments to stop supplying subsidized gas/fuel to their dear neighbors, led to spectacular price increases and this crises triggered change in behavior: insulation of autoclaves, recycling of hot autoclave water. It is only the beginning, but the trend is clear: companies saving energy with efficient operations will be more competitive.

Production cost per hour (steam, electricity)	124	
Production volume per hour (ton/hour)	2	
VC2	**62**	*10%*

Calculation of VC2 is not easy. A detailed explanation is give in paragraph 5.2.2.

Pasteurizing. Another area of great concern affecting both VC2 and the product quality (hence P) is the soviet system of pasteurizing (always improperly called 'sterilization'). GOST prescribed the so-called 'sterilization regime for apricot puree in 3 liter jars' as follows: 25-60-25/105. This example means: 30 minutes heating up to 105°C; then cook it for 60 minutes at 105°C and then 30 minutes for cooling down again. In other words, the apricot puree would be in the autoclave for almost 2 hours. It is processing fact that the longer a product is exposed to heat over 30°C, the more it will discolor and loose taste, hence the lower the quality. According to modern knowledge a regime of 25-5-25/95 is sufficient for apricot puree: half the time, half the steam, double the quality! But

apparently hard to believe! Recent training and demonstrations were held by ITC, Geneva, in factories in Tajikistan and Kyrgyzstan. From 12 participating factories (all before the harvest season started) only 2 adopted (partially) the newly learned skills. In one factory, the reason for not applying the skills, despite being convinced, was that their labels stated 'produced under GOST' and this was not a GOST procedure. The time to convince Tajik Standards was longer than the harvesting season. Training and demonstration is useful but needs steady follow-up and pushing to change behavior.

Labor. Cheap labor is always said to be an advantage. In reality this is not true. What counts is labor productivity. Cheap hands, cleaning the peel of an apricot with a razor blade before it is being dried or frozen is great asset as long as the cost per kg remains competitive. Very few AGROPROCESSING processing companies in the region apply bonus systems for increased productivity. In one Armenian company, for instance, the cost of labeling (sticking the label on a jar) went down by 48% after introducing payment per label, instead of a fixed salary.

3. **VC3. Cost of packing** is straightforward primary plus secondary packing cost are easy to get: price of the glass jar, the cap, the label, the carton box, the shrink foil. For juices packed by TetraPak or CombiBlok lines: the cost of the aseptic paper, the lid, the straw and the shrink foil. What is less obvious is the availability of good quality packing material. Soviet style glass jars 'bankas' are being produced in almost countries in Caucasia and Central Asia, but the quality is not good resulting in losses during filling and capping, this is referred to as 'brak'. Brak is a loss factor accepted by management and is reported and calculated in the cost of packing. Imported glass jars from China is sometimes an option, but the quality depends on the manufacturer and for better quality a higher price must be paid. Aseptic carton paper for filling juices must always be imported and paid for in foreign currency. In a country like Uzbekistan, with strong currency regulation, this is not always easy.

Cost of packing (aseptic bag, drum)	21.8	
Number of drums per ton	4.5	
VC3	**99**	*16%*

3. FC, Fixed Costs

The Cigar Box divides FC in to three categories: FC1: depreciation; FC2 cost of financing; FC3 all other overhead, including salaries for factory workers not included into VC2.

FC1. Depreciation. In 90% of all factories in the FSU countries, the equipment and the buildings are old and written-off. Owners and management have a tendency to conveniently forget to depreciate. And lower their cost price. This results into lack of cash for future investments, even for replacement investments. The Cigar Box suggests to include always a realistic amount of depreciation, which, if saved on a separate account, will enable the entrepreneur to make the future investments needed. Purchase value minus residual value at the end of the economic life, divided by the number of years. The economic life depends on the costs for maintenance and repairs which tend to increase over time. The equipment should be replaced when annual repair and maintenance costs become higher than the annual depreciation.

Asset value	1,800,000	
Depreciation %	7.8%	
FC1	**140,000**	*41%*

FC2. Interest. This cost is usually transparent as bank loans are seldom hidden. Interest rates can be as high as 25% per year. Shortage of working capital is sometimes the result of the fact that the owners believe that they will not be able to repay the loans at such interest rates, which is a clear proof that education in cost pricing is still very much needed.

Debt (40% of Asset value)	720,000	
Interest rate	18.7%	
FC2	**134,400**	*39%*

FC3. Overhead. Salary records are kept by all companies. To avoid paying income tax and especially social taxes, the salary levels are usually kept artificially low. Payment in kind (the product produced) is still regular practice. The real payment for top management and owners is always hidden from the books. In most cases, these are paid from the earlier described under-invoicing (see 1. Sales Price). The fixed costs are systematically underestimated and must be adjusted to include future investments and a realistic salary for management.

Number of FTE employed	15	
Salaries staff incl. social taxes	50,000	*15%*
Other overhead, repairs, maintenance	20,000	*6%*
FC3	**70,000**	*20%*

FC attribution. If a company has one single product, all fixed cost must be earned by that product. The FC % attributed to the product box will be 100%.

FC	**344,400**	*100%*
FC % attributed to product	100.0%	
FC (attributed to product)	**344,400**	

However in almost al cases, more than one product will be produced and the fixed cost must be divided among the products in the portfolio. Fixed cost attribution is carried out automatically in Cigar Box 2 (see next Chapter). In CB1 the user must make an educated guess.

4. q, the volume sold (and produced!)

Volume sold q (ton)	3,600
Contribution	**554,956**

This is the single most difficult parameter to predict during any due-diligence or fact-finding mission. The experience of the last 10 years in the region has proven that it is more difficult to produce than to sell. The reasons for this can be summarized in order of importance:

1. Poor raw material procurement
2. Lack of (timely) working capital
3. Poor harvests due to:
    i. inadequate irrigation
    ii. inadequate fertilization and pest control (even if inputs and sprayers have been supplied by the processor)
    iii. inadequate crop management (too late weeding, bad/no pruning of trees)
    iv. old orchards

Contract farming is still at the beginning stages. Several processing companies in Kyrgyzstan lease land from the Government and recruit farmers to work on it. With mixed results: diversion of money to be used for inputs, selling the harvest at a slightly higher price on the market… The best results were reported on farms where Chinese farmers were recruited: no theft, higher yields. The importance of contract farming cannot be overestimated.

This does not mean that sales and marketing are now unimportant, only: the market potential is much bigger than the companies' ability to produce and sell. The exception to this general rule is the market for fruit juices, because these can be produced easily from (imported) concentrates. The demand for juice is growing at spectacular rates in all countries. Growth figures of 10% are normal. Fruit juice consumption in Kazakhstan rose from 3.4 liter per capita in 1996 to 12.5 liters in 2007, which is an average growth of 13% per annum. All markets are flooded with legally and illegally imported juice, notably from Russia and Ukraine. These brands are very strong and have excellent merchandising and advertising campaigns.

5. T, taxes

Specific tax legislation exists for primary production. In most countries, selling agricultural produce is free of VAT. Nobody in the world likes to pay taxes and farmers and processors in the region are no exception. This factor is not further discussed as tax paying behaviour falls outside the scope of this paper.

6. Gross margin

The gross margin is the difference between the ex-works price and the variable costs. It is calculated per unit (per kg, per liter, per ton). The gross margin is the amount of money which earned when producing and selling 1 unit. You sell for a price P, take out all variable costs VC and what remains (P-VC) contributes to pay for the fixed cost FC. So: gross margin is not the profit, because the fixed costs still have to be paid.

Price (EXW)	**756**	
VC	**602**	*100%*
Gross margin	**154**	
Gross margin %	20%	

7. Gross margin %

The gross margin % must generally be over 30%. This is needed as a buffer against price fluctuations of raw materials or price changes of the finished goods.

Gross margin %	Level	Comment
<15%	Very risky	Only acceptable when the production process parameters and all prices are fully under control.
15-25%	Risky	Only acceptable if production and price fluctuations are within 5-10% range.
25-35%	Normal	
35-45%	Robust	
>45%	Very robust	

8. BE, break-even sales volume

The break-even volume is the quantity of goods that must be sold to cover all fixed costs. In other words, if you sell exactly the break-even volume, you have neither a profit nor a loss.

In formula:

Profit = FC – q x Gross margin
Profit = FC – q x (P – VC)
Profit = 0
FC = q * (P – VC)
BE q = (P – VC) / FC

It is strongly recommended that the Company ensures sales contracts for at least BE volume.

Break even volume (sales)	**2,234**
Break even volume (raw material)	21,600

9. BE, break-even raw material needed

- Once the break-even volume of sales has been calculated, you can now calculate how much raw material is minimally needed to produce sufficient volume to sell. It is very re
- It is strongly recommended that the company ensures raw material procurement contracts for at least the BE volume.

10. Contribution (P-VC) * q

The contribution is the gross margin (P-VC) per unit multiplied by the number of units sold. The most difficult parameter in this formula is to predict is the volume that will actually be sold. Raw material supply and the sales capacity limit actual sales.

Gross margin	**154**	Volume sold q (ton)	3,600
Gross margin %	20%	**Contribution**	**554,956**

Recommendations for management

Contribution analysis	*Gross margin low*	*Gross margin high*
Volume low	Eliminate the product or make changes in cost price or in sales price; increase raw material supply	Strengthen marketing to increase sales; And/or increase raw material supply
Volume high	Change technology, equipment to reduce costs	Cash Cow, defend your position

11. Capacity utilization

With the raw material requirement and the processing ratio known, the Cigar Box calculates the utilization of the capacity. The following parameters must be filled in:

- capacity of the equipment installed on units per hour (Note: input capacity or output capacity)
- length of the harvesting season in days
- number of hours work per day

Multiplying the number of harvesting days by hours per day gives total operation hours. Multiply total operation hours by capacity per hour and the result will be the capacity in units per year/season. Dividing the tons actually produced or planned by the capacity results in the capacity utilization %. For most industries this must be over 75%.

Input capacity per hour in ton	12.0
Working hours per day	22
Length of harvesting season in days	110
Max. input capacity per year	**29,040**
Capacity utilization %	74.4%

12. Profit and profitability %

The profitability of agro-processing companies fluctuates heavily as can be seen in the sample Cigar Boxes provided in the Annex. Generally speaking, agro-processors who sell consumer products have larger margins, but smaller volumes than processors of an intermediate product like tomato paste or apricot puree.

	USD per year
Total Revenue	2,721,600
Total Cost	2,511,044
Profit Before Tax	**210,556**
Profitability %	8%

Chapter 4 CB 2 Portfolio Analysis

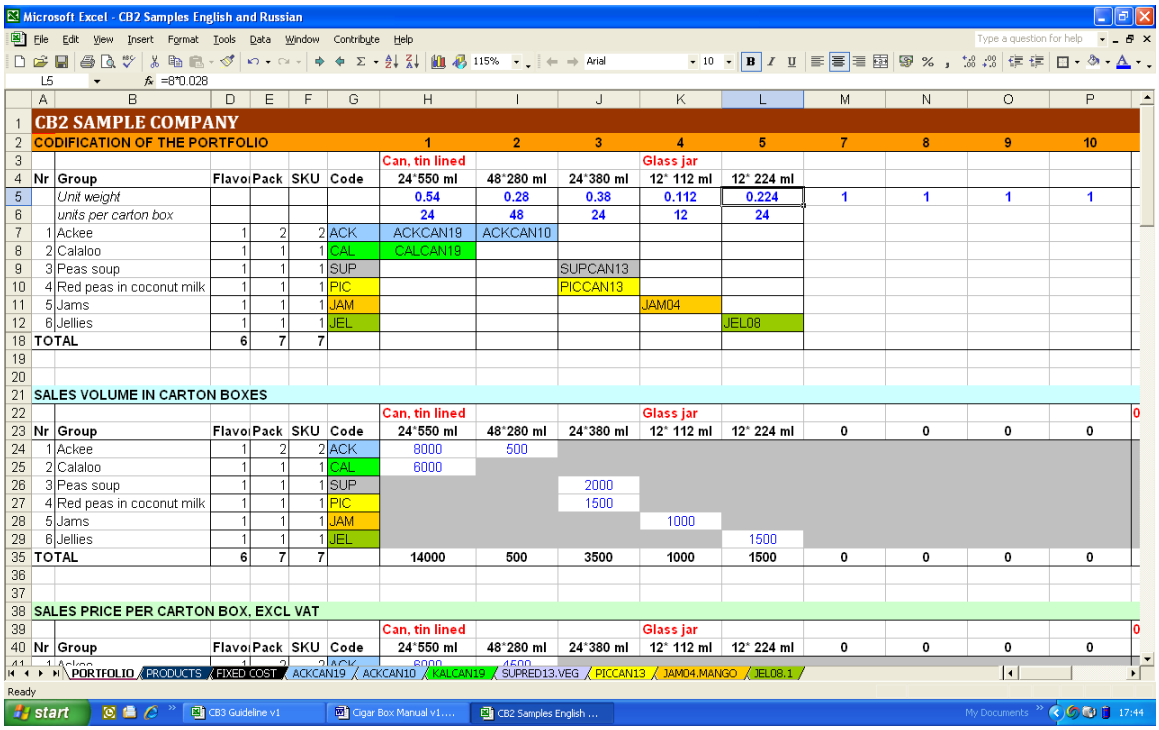
4.1 CB2 is a Planning Tool.

CB1 is an instrument of calculation; CB2 is a planning tool. It helps management to expand or shrink their portfolio of products. It contains multiple CB1 sheets: one sheet for each SKU.

CB2 provides information to conduct the following types of analysis at SKU level:

- Gross margins analysis: analyze risk of price fluctuations on the margins; margins must usually be over 30% in agro-processing industries.
- Contribution analysis: analyze which products are the most important ones for the company; usually the 80-20 rule (Pareto) applies.
- Sensitivity analysis: calculate the effect of changes in the essential cost parameters on the profitability of the enterprise (similar to gross margin analysis)
- Break-even analysis: calculate which volume must be produced (and sold!) to have sufficient contribution to pay for all fixed costs; is the volume where no profit and no loss is made.
- Profitability analysis: analyze if the portfolio brings sufficient profit to compensate owners risks.

Figure 3 - Screenshot of CB2 - Portfolio sheet



Cigar Box® 2 Portfolio Analysis can be applied to current or past operations, planning future operations and even for overall business planning for several years. It allows receiving sufficient information to take decisions in the following areas:

- Supply and stock management
- Sales and marketing
- Product portfolio adjustment
- Cash flow planning (CB2 Plus)
- Investment planning (CB4)

SHORT OVERVIEW OF THE STEPS TO IMPLEMENT

- **STEP 1: Determine all SKUs and codify the portfolio**
  - Identify all product categories
  - Define a code and color label for each product or product category
  - Identify all types of packaging used in each category
  - Define a code for each package type/volume
  - Make a coding system for SKU's
  - Codify all SKUs in provided table (one SKU=one Code)

- **STEP 2: Find and fill in all relevant data**
  - Fill in Fixed Costs sheet with relevant data
  - Create one CB1 sheet for each SKU
  - Label each CB1 sheet with appropriate SKU code and color
  - Fill in all necessary data for each SKU CB1

- **STEP 3: Data processing**
  - Calculate gross margin for each SKU (see CB1)
  - Estimate the annual sales volume for each SKU
  - Calculate the annual contribution
  - Rank SKU's according to importance in contribution
  - Distribute Fixed Costs among SKUs using one of available methods
  - Calculate Break Even points
  - Estimate profitability

- **STEP 4: Analyze data and make conclusions**
  - Gross margins analysis
  - Contribution analysis
  - Sensitivity analysis
  - Pareto analysis
  - Break-even analysis
  - Profitability analysis

4.2 Step 1: Determine all SKUs and Codify the Portfolio

Codification is a necessary step to systematize the work processes in the factory. Codification of all finished products (SKUs) should be done in a systematic manner using the following parameters:

- Product category
- Product

- Type of packaging
- Volume of packaging

SKU is abbreviation for a Stock Keeping Unit – individual product, with certain product and packaging characteristics, produced at the plant.

Example of SKUs at dairy and F&V processing plants:

Dairy plant

	Type of packaging		
Product	250 ml.	500 ml.	1000 ml.
Milk		+	+
Kefir	+	+	
Smetana		+	

Total number of SKUs is five (5).

F&V processing plant

	Type of packaging		
Product	1l. jar	2l. jar	200 kg. AB
Tomato paste	+	+	+
Apricot juice		+	
Strawberry jam	+	+	

Total number of SKUs is six (6)

Information about all SKUs should be provided in PORTFOLIO sheet of the Cigar Box 2:

- Identify all product categories and individual products
- Invent a code for each product category
- Identify all types of packaging used in each category (packaging material, cap type, volume, etc.)
- Invent a code for each package type/volume
- Make a coding system for SKU's (which is a combination of a product code and a packaging code, which makes it individual)
- Codify all SKUs in provided table (one SKU=one Code)

Figure 4 - Portfolio codification table of the CB2

CB2 SAMPLE COMPANY											
CODIFICATION OF THE PORTFOLIO						1	2	3	4	5	
						Can, tin lined			Glass jar		
Nr	Group	Flavo	Pack	SKU	Code	24*550 ml	48*280 ml	24*380 ml	12* 112 ml	12* 224 ml	
	Unit weight					0.54	0.28	0.38	0.112	0.224	
	units per carton box					24	48	24	12	24	
1	Ackee	1	2	2	ACK	ACKCAN19	ACKCAN10				
2	Calaloo	1	1	1	CAL	CALCAN19					
3	Peas soup	1	1	1	SUP			SUPCAN13			
4	Red peas in coconut milk	1	1	1	PIC			PICCAN13			
5	Jams	1	1	1	JAM				JAM04		
6	Jellies	1	1	1	JEL					JEL08	
TOTAL		6	7	7							

Remarks to the picture:

1. *Include all products, produced at the plant*
2. *Include all packaging used at the plant*
3. *Indicate weight of each unit (in kg.)*
4. *Indicate number of units per wholesale packaging (carton box, crate, shrink wrap, etc.)*
5. *Indicate number of flavors, types of packaging and SKUs per each product*
6. *Don't forget to give each group an individual color*

In addition to codifying the goods sold, all raw materials, ingredients, packaging items and chemicals, disposables etc. used the factory should be coded. A company may have well over 100 code items and a systematic approach is needed. This falls outside the scope of this Chapter.

4.3 Step 2: Find and Fill all Relevant Data

CB2 contains several forms, which has to be filled with relevant data to enable a thorough and efficient data analysis. As it has been mentioned above, the CB2 tool can be used both for current situation analysis and planning purposes. Based on it, either current of expected data should be filled into CB2.

Here is the list of forms/tables, which should be filled:

Form name	Location in CB2	Description	Reference
Sales volume	PORTFOLIO sheet	Actual sales in a certain time period or expected sales for each SKU should be filled.	-
Sales price	PORTFOLIO sheet	Actual or expected sales prices of each SKU should be filled	-
Fixed costs	FIXED COST sheet	All Fixed Costs – FC1, FC2, FC3 – should be calculated and filled	See Cigar Box 1
Cigar Box 1	Individual sheets for each SKU	All CB1 relevant information should be filled for each SKU	See Cigar Box 1

Figure 5 - Example of 'Sales volume' form

SALES VOLUME IN CARTON BOXES

						Can, tin lined		Glass jar		
Nr	Group	Flavo	Pack	SKU	Code	24*550 ml	48*280 ml	24*380 ml	12* 112 ml	12* 224 ml
1	Ackee	1	2	2	ACK	8000	500			
2	Calaloo	1	1	1	CAL	6000				
3	Peas soup	1	1	1	SUP			2000		
4	Red peas in coconut milk	1	1	1	PIC			1500		
5	Jams	1	1	1	JAM				1000	
6	Jellies	1	1	1	JEL					1500
TOTAL		**6**	**7**	**7**		**14000**	**500**	**3500**	**1000**	**1500**

Remarks to the picture:

1. *In order to ensure that only proper cells are filled, the Excel sheet is programmed in such a way that you have to fill only white cells (they become white as soon as you introduce a new SKU code in the portfolio codification table above)*
2. *Indicate sales volumes in wholesale units (if applicable) per each SKU*
3. *Wholesale unit = final wholesale packaging (which usually contains several individual units – tins, jars, etc.), such as carton boxes, several jars in shrink wrap, crates, etc.*

Figure 6 - Example of 'Sales price' form

SALES PRICE PER CARTON BOX, EXCL VAT										
						Can, tin lined			Glass jar	
Nr	Group	Flavo	Pack	SKU	Code	24*550 ml	48*280 ml	24*380 ml	12* 112 ml	12* 224 ml
1	Ackee	1	2	2	ACK	6000	4500			
2	Calaloo	1	1	1	CAL	2000				
3	Peas soup	1	1	1	SUP			2500		
4	Red peas in coconut milk	1	1	1	PIC			2500		
5	Jams	1	1	1	JAM				900	
6	Jellies	1	1	1	JEL					2000

Remarks to the picture:

1. *In order to ensure that only proper cells are filled, the Excel sheet is programmed in such a way that you have to fill only white cells (they become white as soon as you introduce a new SKU code in the portfolio codification table above)*
2. *Indicate sales prices per each wholesale unit (if applicable)*
3. *Prices can be indicated either including or excluding VAT*

Fixed Costs and individual CB1 forms (for each SKU) should be filled following instructions provided in 'Cigar Box 1' section of the manual. It should just be mentioned that Fixed Costs are filled only one time – they are automatically distributed among all CB1 sheets.

Again, don't forget that only blue numbers are assumptions and can be changed. Black numbers are formulas and are calculated automatically. There is also one pink link, which is calculated based on contribution of each SKU in the company. It should also not be changed.

4.4 Step 3: Data Processing

In addition to the calculations in Cigar Box 1, some additional data for analysis is introduced:

1. Contribution
2. Contribution %
3. Fixed cost attribution %

1. Contribution

The contribution indicates how much money an SKU contributes to cover the fixed cost and the profit of the company. Contribution is the multiplication of gross margin by volume: GM * q. The general rule is that products sold in a large volume have lower margins, e.g. tomato paste. Products which are sold in small volumes fetch higher margins: consumer products like organic strawberry preserve.

2. Contribution %

The contribution % is the contribution of a single SKU as percentage of the Total Contribution of all SKU's. In most companies a Pareto Analysis shows that 80% of the contribution is generated by 20% of the SKU's. It is very important to decide if it is indeed economically viable to produce all SKU's or rather to specialize in the SKU's which contribute most.

3. Fixed cost attribution %

The Cigar Box uses the Contribution % to distribute the fixed costs over the SKU's in the portfolio. This is the principle of: *"the strongest shoulders must carry the heaviest weights".*

Figure 7 - Example of Final CB2 data table

CB2 SAMPLE COMPANY												
1	2	3	4	5	6	7	8	9	10	11	12	13
Nbr	Sheet	Sales in USD	Sales %	Margin per ton	Margin %	Volume BE	Volume	Vol. %	Contribution	Contrib %	FC attrib.	Profit
1	ACKCAN19	53,600	21.7%	244	37%	47	82	2.1%	19,980	29.9%	11,448	8,532
2	ACKCAN10	17,224	7.0%	469	51%	11	19	0.5%	8,860	13.3%	5,076	3,783
3	CALCAN19	50,933	20.6%	3	6%	688	1,200	31%	3,149	4.7%	1,804	1,345
4	SUPCAN13	38,400	15.6%	12	25%	458	800	21%	9,709	14.6%	5,563	4,146
5	PICCAN13	24,000	9.7%	30	62%	286	500	13%	14,947	22.4%	8,564	6,383
6	JAM04.MANGO	42,093	17.0%	6	12%	470	820	21%	4,939	7.4%	2,830	2,109
7	JEL08.1	20,640	8.4%	12	25%	246	430	11%	5,139	7.7%	2,944	2,195
		246,890	100%	**17.3**	**27.0%**	**2,206**	**3,851**	100%	**66,724**	100%	**38,230**	**28,493**
												11.5%

The major value of the CB2 is opportunity to collect data about all SKUs, produced and sold at enterprise in a single, simple, table. Final data table is located at PRODUCTS sheet of the CB2. It is combined here using links from individual SKU cigar boxes' cells.

4.5 Step 4: Analyze Data and Make Conclusions

CB2 provides sufficient information to conduct the following types of analysis:

- Gross margins analysis
- Contribution analysis
- Sensitivity analysis
- Pareto analysis
- Break-even analysis
- Profitability analysis

Cigar Box® 2 Portfolio Analysis can be applied to current or past operations, planning future operations and even for overall business planning for several years. It allows receiving sufficient information to take decisions in the following areas:

- Supply and stock management
- Sales and marketing
- Product portfolio adjustment
- Cash flow planning
- Investment planning

4.6 Example

The CB2 Sample Company in *Figure* 7 above has six different products, each indicated with a separate color. The blue product (ACKEE) is sold in two sizes of packaging: CAN19 and CAN10. All other products are produced in just one type of packaging. Hence, 7 the SKUs in column 2. Each SKU has its own CB1 sheet. After filling the seven CB1 spreadsheets the table in *Figure* 7 is automatically generated. And the following can be concluded:

Total sales amount to $246,890 (column 3). The sold volume is 3,851 ton (column 8) with an average margin of $17.3 per ton (column 5) and this generates $66,724 in contribution (column 10). Because the fixed cost are only $38,230 (column 12) a profit (before tax) was made of $28,493 or 11.5% of sales. This nice end result hides large differences between SKU's.

ACKEE (a salty fruit popular in Jamaica) has enormous margins: $244 per ton for CAN19 and $469 per ton for CAN10 (column 5). The margins % are also comfortable: 37% and 51%. (column 6). The sales volumes on the other hand are very small (column 8). Ackee accounts for only 2.6% of the sales volume in ton (column 9). It is a typical high value-low volume product. The contribution of the two Ackee products is $28,840 (column 10) or 43.2% of the total portfolio (column 11). After deducting their attributed fixed costs (column 12) ackee generates $12,316 of profit (column 13).

CALALOO is a green vegetable (also grown in Jamaica). CALCAN19 is the largest SKU in volume with 1200 ton per year, or 31% of the total sales volume. The margin is only $3 per ton or 6%: a very risky business. And it only contributes $3,149 per year; less than 5% of the total. The question is: should such a large share of the production (31% of the volume produced) be dedicated to such a risky, low margin product?

As stated in the explanation of CB1, Cigar Box does not answer this question. It just signals what the situation is: 2 red lights; 2 orange lights and 3 green lights. It asks questions!

Note 1. This case is from a real factory in Jamaica. After questioning the owner, an interesting explanation came out: the ackee fruit is a capricious fruit. It is very labor intensive and relatively high skills are needed to process it. He works with mostly female workers from the neighborhood of the factory. But the moments of ackee harvesting (two harvests per year) are unpredictable and the available volumes are small. To complicate matters further, the ripe ackee must be processed within 24 hours otherwise a poisonous toxin will develop making the product useless. Processed ackee generates between $250 and $450 per ton, so he does not want to miss a ton! To mobilize sufficient manpower from the nearby villages takes too much time. Thus, during the season, the owner and his workforce must always be on standby waiting until 'the ackee comes'. He obviously cannot afford to keep his workforce being idle and therefore he lets them process calaloo manually, which is abundantly available. Calaloo cutting can be done 20 times faster (thus cheaper) using a mechanical cutter but he needs his workers to be on standby for the ackee. It is a symbiosis situation: calaloo helps ackee to make a profit.

Note 2. The low margin for mango jam was not expected by the owner. We analyzed his CB1 and compared his recipe and processing ratio with international benchmarks and it turned out that 1. more sugar was added than needed (too high Brix), 2. pectine dosage was wrong making it a jelly like, lower quality, lower priced product and 3. packaging cost were too high. After implementing these improvements, the margin was increased to $14 per ton or 25 and the profit increased from $2,109 to $5,276.

Chapter 5 CB3 Operational Monitoring System

CB1 is an instrument of calculation; CB2 is a planning tool; CB3 is a monitoring tool. It helps management to track production cost for each SKU and every day.

It is important at this stage to note that CB3 can be used by both large enterprises (over $2,000,000 sales and > 40 SKU's) and by small and medium enterprises. However, the complexity and the amount of data will obviously differ. In principle the entire chapter is written for both categories of companies. Where appropriate differences are indicated.

CB3 monitors three core steps in the processing flow:

1. Raw material intake
2. Production costs
3. Finished goods

1. Raw material intake module in CB3 provides daily information on:

- Name of supplier
- Date and time of intake
- Volume
- Key quality indicators (fat contents, Brix, pH, etc)
- Price

2. Production cost module in CB3 provides daily information at SKU level on:

- Processing ratios
- Losses in kg and in %
- VC1, VC2, VC3, gross margin and contribution for the production day
- VC1, VC2, VC3 and gross margin per ton
- VC1, VC2, VC3 as % of total VC

3. Finished goods module in CB3 provides daily information at SKU level on:

- Sales price
- Opening stock
- Incoming finished goods
- Outgoing finished goods
- Finished goods returned unsold
- Storage losses
- Closing stock

CB3 is applied for current operations. It generates databases containing the information above. When a sufficient number of records are entered (minimum 2 months of intake/production/sales data) **benchmarks** can be calculated. This allows receiving sufficient information to take decisions in the following areas:

- Raw material procurement management
- Production management
- Stock management (just in time)
- Cash flow management
- Human resources management and payment by productivity

SHORT OVERVIEW OF THE STEPS TO IMPLEMENT

1. Understand and map all **detailed production processes** of the company
   - Technologies used
   - Equipment used
   - Prepare functional flow chart

2. Identify **sources of CB1 information** in the company for:
   - P_{EXW} Sales prices ex works
   - P_{RM} Raw material prices delivered to the factory
   - VC1 Variable cost of raw material and ingredients
   - VC2 Variable cost of processing raw material into the finished product
   - VC3 Variable cost of packaging the finished product
   - FC1 Fixed cost of depreciation of equipment, machinery and buildings
   - FC2 Fixed cost of lending, interest, bank charges
   - FC3 Fixed cost of overhead, salaries, taxes, marketing, maintenance

3. Prepare information **collection forms** suited to the needs of CB3
   - Adapt as much as possible the existing reporting system
   - Make the documents ISO 22000 compatible (=ensuring traceability)

4. Assign reporting **responsibilities** and systematize information processing
   - Appoint a cost accountant, an 'Anushik', a person who understands cost-accounting and has the authority to obtain information throughout the company. It is important that the cost accountant has the ability and willingness to learn more about the underlying technological processes and has a basic understand of the equipment used in the plant.
   - Filling and checking the forms
   - Entering data into CB3
   - Prepare reports

5. Train staff to **change attitude** towards work: measure → know → learn → improve → profit!
   - Learning by doing
   - Learning from mistakes
   - MEASURE and LEARN

6. Change **reporting discipline**: inform management / owners honestly!
   - Report daily cost of production
   - Report the real losses
   - Make daily evaluation of problems and ask responsible technical persons to list causes
   - IMPROVE EFFICIENCY

7. Change **salary system**: reward improvements, reward objectively!
   - Report the real labor productivity
   - Report if targets were achieved
   - PAY PRODUCTIVITY

STEPS 5, 6 AND 7 FALL OUTSIDE THE SCOPE OF THIS MANUAL

5.1 CB3 Information Flow Chart

CB3 utilizes a generic information flow chart for ALL its processes, regardless of the type of industry. The flow of information starts with the collection of data from primary documents in the factory: raw material intake register, laboratory inspection reports, factory production registers etc. For small companies this is a fairly easy job; in large companies however, a lot of data are collected in different places and the identification of sources is more complicated. This is described in more detail in paragraph 5.3 below.

These primary data are used to fill in CB3 DATA COLLECTION FORMS in Word. These word documents are used to 'transfer data from the factory to the central data computer'. They are archived in a special CB3 archive so that information can always be traced back (see paragraph 5.4 for more details)

Because the organisation of data collection, entry and reporting is a specialist task, we recommend the appointment of a special cost accountant. He/she will be trained during first time installation by a Certified Cigar Box Trainer and can thereafter take the task of data entry on his/her own. This is described in paragraph 5.5.

The Word documents in turn are used to enter information into CB3 Excel. Figure 8 shows the various links. The central data entry sheet is F4 where the cost prices and margins of all SKU's are calculated on a daily basis. Correct data entry and verification is the subject of paragraph 5.6.

Once the data are entered, CB3 automatically produces 4 output tables; see paragraph 5.7.

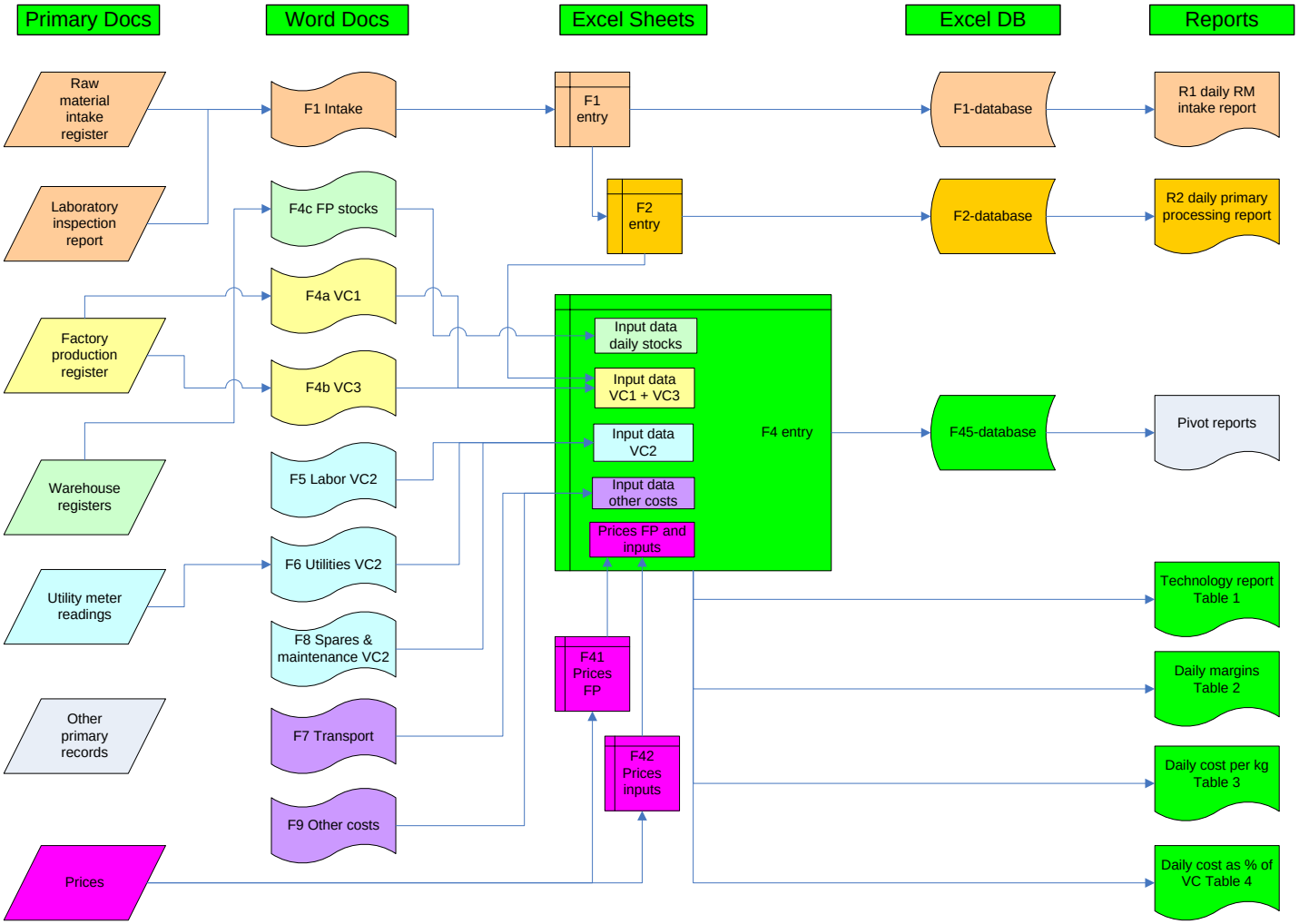
Paragraph 5.8 describes data analysis. CB3 makes use of two types of analysis: benchmarks using Conditional Formatting and pivot tables from the F45 database.

In the flow chart on the following table this information flow is graphically displayed.

However, prior to dealing with information collection, entry and analysis, we believe it is of UTMOST IMPORTANCE that the person responsible for CB3 has a thorough understanding of the technical and technological processes in the factory. This is the therefore the first paragraph in this chapter.

GOOD LUCK!

Figure 8 - CB3 Information Flow Chart



5.2 Understand and Map Detailed Production Processes

Four types of maps and diagrams are helpful to understand the production processes of a company:

1. Map of the factory layout helps to understand the size of the land, the buildings and storages, which production lines are available and where these are located. Which utilities are available? This diagram can be produced by the owner/general manager.

2. Equipment diagram helps to understand the basic technology an equipment used to process a raw material into a final product. It is usually a standard diagram which can be found on the internet. This equipment diagram is the key to calculate VC2. It is produced by the engineer.

3. Production process diagram helps to understand how multiple products are produced from a single raw material. It is more company-specific but still quite general. This equipment diagram is essential to calculate VC1. It is produced by the technologist.

4. Functional processing diagram merges the first two diagrams into one company-specific chart indicating all basic functional processes:
   - Intake and grading
   - Processing lines, including filling and sterilization
   - Storage of raw material, intermediate and finished products
   - Utilities: water, gas, electricity, steam, compressed air

   This diagram is produced by the cost accountant in cooperation with the engineer, technologist, the production manager and the owner/general manager.

5.2.1 Map of the factory layout

A map of the factory helps to understand the size of the land, the buildings and storages, which production lines are available and where these are located. We recommend two support tables to describe the infrastructure and the utilities. See tables below.

Table 1 - Example of description of infrastructure

Description	Size in m2	Volume in m3	Condition (1-5)	Remarks
Surroundings	-		4	Surroundings belong to several factories
Storage facility 1	200	720	1	Under construction; est. date of completion April 2008
Storage facility 2	40	-	4	Used to store raw material before it is processed (mostly for puree lines)
Storage facility 3	200	-	-	Belongs to Aprosakh Company (shareholder); Factory can freely use it
Production facilities	1188	-	4	-
- Walls			4	-
- Floors			3	Several places need repair (plm. 20 m2)
- Windows			4	-
- Lighting			4	-

Table 2 - Example of description of utilities

Utility	Equiment	Capa-city	Price / Cost	Year of construction	Condi-tion (1-5)	Remarks
Steam	Boiler	12 ton/hr	192 liter diesel/hr at 39/lt per 12 ton = 620.7 / ton	New boiler under construction (ready: Jun 2007)	1 (old) 5 (new)	The new boiler can be BIO fuelled
Electricity	municipal	-	0.925 / kWh	-	-	
Water 1	Borehole	4 m3/s	0.702 / m3	2001	3	
Water 2	municipal	-	1.8016 / m3	-	-	
Sewage	municipal	-	6.90 / m3	-	-	

5.2.2 Equipment diagram to help calculating VC2

This diagram helps to understand the basic technology an equipment used to process a raw material into a final product. It is the basis for calculating VC2 and a separate table is presented as a guideline on how to make a detailed inventory of the production process. This diagram and the associated table are usually made by the company's engineer.

Diagram 1 – Equipment diagram of tomato paste, with jar and aseptic drum filling

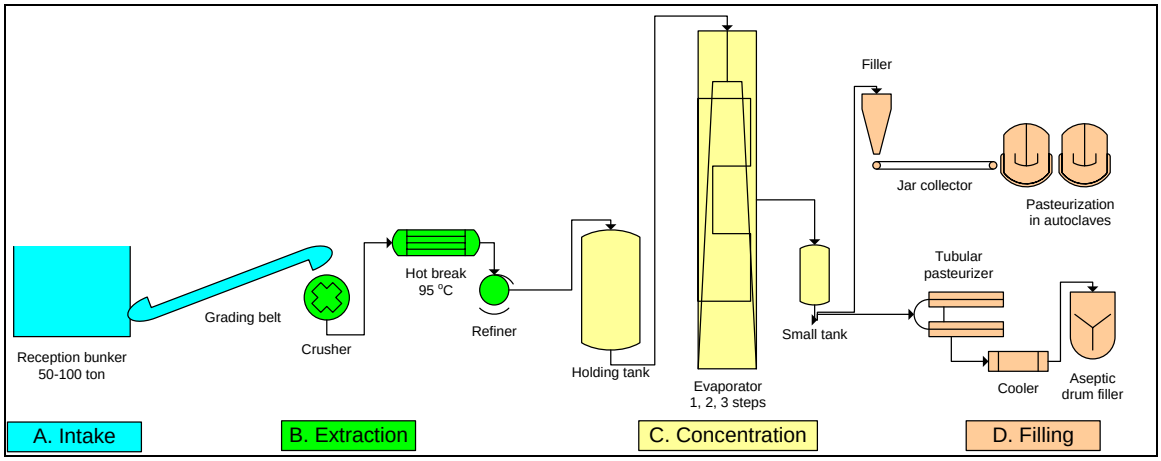


Table 3 - Example of description of a processing line (tomato paste)

Name of line 1: TOMATO PROCESSING LINE
Possible products: tomato paste, tomato juice, tomato marinades, paprika in tomato juice (lecho) **At present time:** tomato paste = 99% of production, other products = 1% (test products)
Year of construction / rehabilitation: 2003

Most equipment was made in 1976 in Hungary

Step		Process description	Num-ber	Pro-cess type *)	Batch length in minutes	Batch volume in ton	Capacity in ton per hour	RM or FP **)	Steam use in ton per hour	kW use per hour	Workers needed per hour
A Intake	1	Weigh bridge	1	Batch	20	up to 90 ton	270	RM		220	1
	2	Reception bunkers (reception, washing)	5	Cont.	-	-	15	RM			1
	3	Grading/inspection conveyer	2	Cont.	-	-	20	RM			2
B Extraction	4	Crushing/chopping machine	2	Cont.	-	-	15	RM			
	5	Accumulator (collecting, mixing)	1	Cont.	-	-	15	RM			
	6	Screw pumps	2	Cont.	-	-	15	RM			
	7	Heaters	2	Cont.	-	-	15	RM	0.80		2
	8	Grinding/crushing (three-stage)	2	Cont.	-	-	20	RM			
	9	Accumulators of juice	2	Cont.	-	-	15	RM		80	
	10	Pumps	2	Cont.	-	-	15	RM			
C Evapo-ration	11	Evaporator (three stage, made in Hungary) (7.5 kg tom. = 1 kg paste)	1	Cont.			20 RM -> 2.7 FP	FP	4.12	140	1
D Filling 1	12	Heater, sterilizer + cooler (made in Bulgaria)	1	Batch	6	0.2	2.0	FP	0.36	25	2
	13	Filling line 18 heads (made in Bulgaria) 3000 units/hr	1	Cont.	-	-	2.7	FP		12	7
	14	Capping machines	3	Cont.	-	-	2.7	FP			
	15	3 Autoclaves (made in the USSR)	3	Batch	90	3 * 0.45 = 1.35	1.35 / 1.50 = 0.90	FP	0.72		1
	16	2 Autoclaves horizontal (made in Italy)	2	Batch	90	2 * 2.25 = 4.5	4.5 / 1.5 = 3.0	FP	0.72	0.1	1
Filling 2	17	Aseptic filler equipment – Filler (2 filling heads) (Elpo Italy)	1	Batch	12	0.2	1.0	FP		2.5	
E Labels	18	Auto-labeling machine	1	Cont.	-	-	10	FP		15	3
	19	Pallet, plastic wrapping machine	1	Cont.	-	-	10	FP			
F Storage	20	Moving products to storage facility		Cont.	-	-	-	FP			3
								Total	**6.00**	**494.6**	**24**
*) Batch means the product flow is not continuous							Price per unit/hour		620.7	0.925	7.0
Cont. means the production flow is continuous							Price per hour		3,724	458	168
							Processing cost per hour				**4,350**
**) RM = tons of raw material							Processing volume per hour				2.00
FP = tons of finished product							**Processing cost per ton (VC2)**				**2,175**

To calculate VC2 of this production line, please note as follows:

- **STEAM**. The total steam use of this tomato paste line is 6.0 m3 per hour (50% of the total steam capacity is thus used for this line); the cost of the steam, calculated in *Table* 2 - *Example of description of utilities* from the quantity of diesel used per hour (192 liters of diesel per hour at 38 per liter for 12 tons of steam) equals 620.7 per ton of steam.
- **ELECTRICITY**. The total use of electricity is 494.6 kilo Watt per hour. Electricity is obtained from the municipal grid and it costs 0.925 per kW.
- **LABOR**. The tomato processing line, when in use, requires 24 people to be employed. They cost 7 per hour.
- **WATER**. The cost of water was not calculated because this factory had no separate water meter. They pay a fixed fee per month. Where possible, water usage should also be calculated separately.
- **TOTAL VC2 PER HOUR**. The total processing costs amount to 4,350 per hour. The output is 2.0 of paste per hour, hence

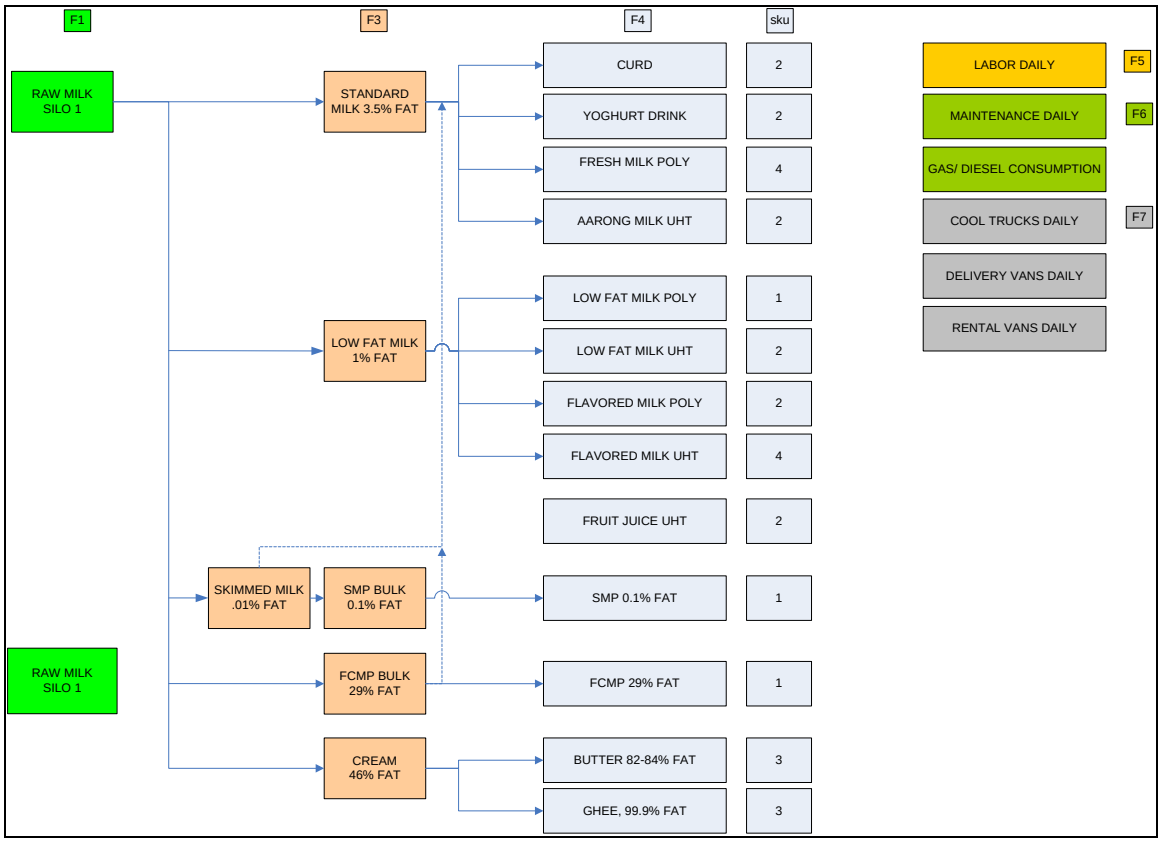
- **PROCESSING VOLUME PER HOUR**. The bottleneck in this factory is step 12, which can only process 2.0 ton of tomato paste per hour. The rest of the equipment is tuned to handle 2.7 ton of paste per hour. Hence the (current) output is 2 ton per hour.
- **VC2 PER TON**. VC2 per hour is 4,350 divided by 2.0 ton per hour = 2,175 per ton. Obviously, it would make sense to increase the capacity of the step up to 2.7 or 3 ton; this would reduce the VC2 by 565 per ton or by 25%!

In CB 3, VC 2 is allocated according to the % contribution of each SKU to the total production volume of that day.

5.2.3 Production process diagram (<u>only for large enterprises</u>)

This is not an engineering diagram, but a technological diagram. It is prepared by the technologist or by the factory's laboratory staff. It shows how raw material, with several intermediate production steps is ultimately used to produced finished products. In this example into 33 dairy SKU's

Diagram 2 – Production process diagram (Dairy Products)



5.2.4 Functional processing diagram (<u>only for large enterprises</u>)

This diagram is the basis of data collection of the cost accountant. It indicates which information is generated by which department and functional responsibilities can now be assigned for daily

entry of cost calculation forms. In the diagram below there are four production departments, each responsible for a group of SKU's which all use more or less the same production lines.

- The white department is milk intake; they fill in Form 1 (F1)
- The purple department manages the pasteurized products (fresh (flavored) milk, yogurt drinks); they fill F3.
- The yellow department manages the two aseptic filling lines (250 ml and 200 ml tetrapacks) for long life milk products; they fill F4.
- The mauve department produces milk powders and the fill F5.
- The blue department is responsible for curds, ghee, butter and butter milk; they fill F6.
- The warehouse manager is responsible for the Intake storage (ingredients and packaging material), the finished goods storage at ambient temperatures (the long life products) and the chilled warehouse for pasteurized finished goods. He fill F2, F7 and F8 respectively.
- The daily usage of utilities is registered in F9.
- Daily transport cost of raw milk into the factory and distribution of finished goods is recorded in F10 by the transport manager.
- Sales and returned goods are reported on F11.

Diagram 3 – Functional processing diagram (Dairy factory)

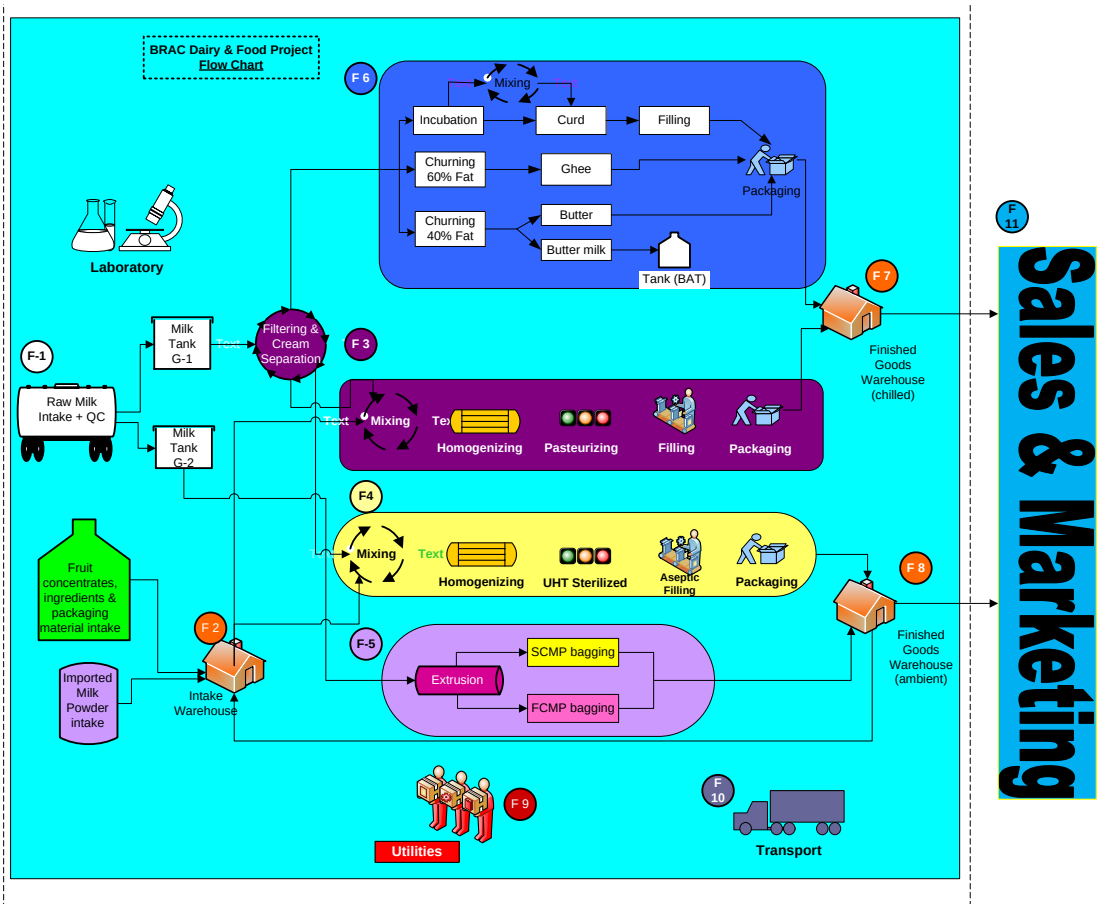


Table 4: Sources of information for CB3

BRAC DAIRY & FOOD PROJECT - CIGAR BOX® OPERATIONAL MONITORING SYSTEM

Nbr	Cost information	Name of register	Qty info	Cost info	UOM	Department	Responsible
1	milk volume	Chilling center register	raw milk volume	volume of milk	Ltr per day	Milk collection	Delouer
2	milk cost	Lab register	CLR; fat%; milk price	cost of milk	BDT per day	Milk collection	Delouer
3	ingredients, packaging	Process register Line 1	kgs, liter, pieces	sum of all expenses	BDT per day	Production	Rabbani
4	ingredients, packaging	Process register Line 2	kgs, liter, pieces	sum of all expenses	BDT per day	Production	Rabbani
5	ingredients, packaging	Process register 2	kgs, liter, pieces	sum of all expenses	BDT per day	Production	Rabbani
6	ingredients, packaging	Process register 3	kgs, liter, pieces	sum of all expenses	BDT per day	Production	Rabbani
7	ingredients, packaging	Process register 4	kgs, liter, pieces	sum of all expenses	BDT per day	Production	Rabbani
8	production labor	Daily labor register	number of workers	cost of workers	BDT per day	Production	Rabbani; Jahangir
9	temporary labor	Daily casual labor register	number of workers	cost of workers	BDT per day	Administration	Rofiq SM
10	maintenance, consumables Poly pack	M/C register 1		sum of all expenses	BDT per day	Engineering	Adhir Saha
11	maintenance, consumables UHT	M/C register 2		sum of all expenses	BDT per day	Engineering	Adhir Saha
12	maintenance, consumables Powder	M/C register 3		sum of all expenses	BDT per day	Engineering	Adhir Saha
13	maintenance, consumables Generator	M/C register 4		sum of all expenses	BDT per day	Engineering	Adhir Saha
14	gas consumption	gas meter reading	m3	cost of gas	BDT per day	Engineering	Adhir Saha
15	diesel consumption	diesel consumption sheet	liters	cost of diesel	BDT per day	Engineering	Adhir Saha
16	cool trucks spare parts	Spare register transport		sum of all expenses	BDT per day	Engineering	Adhir Saha
17	cool truck trip allowances	Tanker schedule	number of trips	cost of allowances	BDT per day	Transport	Mosharaf
18	cool truck diesel consumption	Tanker diesel record	liters	cost of diesel	BDT per day	Transport	Mosharaf
19	delivery vans spare parts	Spare register transport		sum of all expenses	BDT per day	Engineering	Adhir Saha
20	delivery vans trip allowance	Delivery van schedule	number of trips	cost of allowances	BDT per day	Transport	Mosharaf
21	delivery van diesel consumption	Delivery van diesel record	liters	cost of diesel	BDT per day	Transport	Mosharaf
22	delivery van rental cost	Finished products delivery r	crates (10 lt equiv)	cost of delivery	BDT per day	FP storage	Tofajjal; Jahangir
23	non-conformity losses	not existing			BDT per day		??

5.3 Sources of Information (only for large enterprises)

Once a functional processing diagram has been produced by the cost accountant, he can start to identify sources of information needed to fill the forms required by CB3. All companies have existing reporting systems. *Table* 4 above shows an example of a large dairy factory in Bangladesh, which corresponds to the functional process of *Diagram* 3. In this company 22 registers were identified. Everything was indeed registered somewhere. With the exception of non-conformity losses. The problem of this (and many similar) organisation is to systematize the data collection, data entry and data analysis & reporting. This is where the CB3 helps entrepreneurs.

5.4 Design of Data Collection Forms

5.4.1 Forms for large enterprises (>$2,000,000 sales + > 40 SKU's)

Data collection forms for large enterprises are always company specific and can only be designed in practice. It is important that batch codes are reported to ensure traceability. This manual will not provide details.

5.4.2 Forms for small and medium enterprises

As detailed in Figure 8 - CB3 Information Flow Chart, CB3 has standardized data collection for all companies. Key information is collected on a one-page form in Word containing information on the three core elements of CB3:

1. Raw material intake
2. Production costs
3. Finished goods

Form 1: information on raw material intake. Two examples are given.
Form 4: production cost of finished goods
Form 5: cost of variable labor (optional for SME's)
Form 6: cost of processing VC2 (utilities, spares, if F8 is not used, cleaning materials, meals for workers, variable labor, if F5 is not used)
Form 7: Transport cost of raw material and distributed finished goods (optional for SME's)
Form 8: Spare parts and repairs form (optional for SME's)
Form 9: All other costs (transportation, if F7 is not used, fees, taxes, storage and distribution losses)

Data should be recorded and filed on a daily basis in Word documents (forms F1,F4, F6 and F9) managed by the Cost Accountant. This is important to protect against data losses and detect possible errors in data entry. The data should then be entered periodically into Excel to storage and analysis. Section 5.4 explains the Word Forms, section 5.6 then illustrated data entry into Excel.

The **bold and underlined** forms are always used, the other ones are optional. F1, F4, F6 and F9 are integrated into a one-page daily data collection form. See next page.

Note: CB3 offers these forms as a standardized document. At all times, the users can modify them to suit their particular needs. This will also require that the CB3 Excel sheets need to be adjusted.

Cigar Box 3 – DAIRY PROCESSING	Production date "_01_" _July_2009

F1 – Milk Intake Form

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No	Time	Supplier	Price per liter	Volume in liters	pH	°C	Density	Weight in kg	Fat %	Fat in kg	Batch code	Milk not used for separation in liters	Milk used for separation			
													Milk separated in liters	Skimmed milk in liter	Cream in kg	Fat % cream
1	10:00	Ilhom	1.0	850	6.6	19	1.028	873	3.3	28.8	361					
2	10:00	Mutalib	1.1	650	6.3	25	1.026	668	3.3	22	361					
3				1500							361	1200	300	280	20	50%
4	18:05	Ilhom	1.0	400	6.7	18	1.027	411	3.6	14.8	362					
5	19:50	Markazi	1.0	500	6.6	22	1.027	514	3.6	18.5	362					
6				900								900	0	0	0	0

F4a – Use of raw material and ingredients (VC1)

№	Component	Dutch Cheese 45%	Yogurt 7.5%	Finished Product 3	Finished Product 4	Finished Product 5	Finished Product 6	
0	*Batch code*	*361*			*362*	*361*	*361*	
1	Not separated raw milk (liters)	800			900		400	√
2	Skimmed milk (lt)	200			-	7	73	√
3	Cream 50% (kg)	-			-	20		√
4	Ingredient 4 (kg)	-			9			
5	Ingredient 5	0.02			0.018			
6	Ingredient 6	0.4			-			
7	Ingredient 7	25			-			
8	Ingredient 8	4			-			

F4b – Packing of finished products (VC3)

№	Packing material	Dutch Cheese 45%	Yogurt 7.5%	Finished Product 3	Finished Product 4	Finished Product 5	Finished Product 6
1	150 gram						
2	200 gram					135	
3	400 gram				1000		
4	500 gram						
5	1 liter PET bottle				485		450
6	Bulk in kg	85.21					

F4c – Stock of finished products (10 SKU's)

№	Item	Dutch Cheese 45%		Yogurt 7.5%	Finished Product 3		Finished Product 4		Finished Product 5	Finished Product 6	
0	Packaging	150 g	Bulk kg	200 gram	150g	500g	400gr	1lt PET	200 gram	500g	1lt PET
1	Opening stock		1245				0	0	23		0
2	Production		85.21				1000	485	135		450
3	Distributed / sold		100				900	485	115		450
4	Storage losses		0				0	0	10		0
5	Returned unsold		4				20	0	6		18
6	Closing stock		1234				120	0	39		18

F6 – Processing cost (VC2)

№	VC2 costs	Reading yesterday	Reading today	Quantity	Price	Amount
1	Electricity	1340	1390	50	0.165	8.25
2	Water	23,4	27,4	4	1	4.00
3	Diesel			10	2.8	28.00
4	Food for workers					0.0
5	Detergents & cleaning					0.0
6	Spare parts (F8)					0.0
7	Salaries for workers (F5)					0.0
					Total F6	40.25

F9 – Other costs

№	Cost	Quantity	Price	Amount
1	Storage losses (from F4c)	10 x FP5	0.825	8.25
2	Automobile expenses			8.75
3				
4				
5				
6				
7				
			Total F9	17

Prepared by: ***Supervisor:***

Form 1: Information on raw material intake.

This information is collected from milk intake registers and laboratory reports, see Figure 8 - CB3 Information Flow Chart. Use of Cigar Box forms to ensure consistency and that all necessary info is available.

Cigar Box 3 – DAIRY PROCESSING							Production date	"_01_" _July_2009								
F1 – Milk Intake Form																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No	Time	Supplier	Price per liter	Volume in liters	pH	°C	Density	Weight in kg	Fat %	Fat in kg	Batch code	Milk not used for separation in liters	Milk used for separation			
													Milk separated in liters	Skimmed milk in liter	Cream in kg	Fat % cream
1	10:00	Ilhom	1.0	850	6.6	19	1.028	873	3.3	28.8	361					
2	10:00	Mutalib	1.1	650	6.3	25	1.026	668	3.3	22	361					
3				1500							361	1200	300	280	20	50%
4	18:05	Ilhom	1.0	400	6.7	18	1.027	411	3.6	14.8	362					
5	19:50	Markazi	1.0	500	6.6	22	1.027	514	3.6	18.5	362					
6				900								900	0	0	0	0
7																

Notes to F1 (Dairy):

- Columns 1 to 8 are self-explanatory.
- Weight in kg (c9) = volume in liters (c5) x density (c8).
- Fat in kg (c11) = volume in kg (c9) x fat % (c10)
- The batch code (c12) restarts every year on 1 January with number 1 and is consecutive the whole year round.
- Dairy factories receive milk in the morning and in the afternoon/evening (c2). Upon the discretion of the technologist, milk from different suppliers is mixed into a large batch, or not. If it is mixed, the batch total must be added on the form in a separate row (here rows 3 and 6).
- Next, the technologist decides which volume of raw milk he wants to use directly for processing (c13) and which volume he likes to separate (c15). The batch volume in liters (c5) must be equal to the volumes not separated (c13) and separated (c14).
- Separated milk results in a volume of skimmed milk (c15) and cream (c16) with a measured fat contents (c17).

Cigar Box 3 – FRUIT & VEGETABLE PROCESSING									Production date	"_01_" _July_2009						
F1 – Milk Intake Form																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No	Time	Supplier	Raw material	Price in kg	Weight in kg	pH	°Bx	spare	Solids in kg	Lab test	Batch code	RM not used for grading in kg	RM used for grading			
													RM graded in kg	Grade A	Grade B	Grade C
1	04:00	Ghazyan	Tomato	0.4	8500	6.3	4.2		350	ok	451					
2	09:00	Mockler	Tomato	0.4	6500	6.6	4.8		312	ok	451					
3					15000				626		451	15000	0	0	0	0
4	15:05	Hempodh	Apricot	0.45	4000	6.6	18		720	ok	452					
5	21:50	Vandol	Apricot	0.45	5000	6.2	22		1100	ok	452					
6					9000				1820		452	0	9000	5000	3000	1000
7																

Notes to F1 (F&V):

- Columns 1 to 8 are self explanatory. Column 9 is a spare column.
- Solids in kg (c10) = weight in kg (c6) x °Brix (c8).
- The batch code (c12) restarts every year on 1 January with number 1 and is consecutive the whole year round.
- F&V factories receive raw material throughout the entire day (c2). Upon the discretion of the technologist, raw material from different suppliers is mixed into a large batch, or not. If it is mixed, the batch total must be added on the form in a separate row (here rows 3 and 6).

- Next, the technologist decides which volume of raw material he wants to use directly for processing (c13) and which volume he likes to grade first (c14). The batch volume in kg (c6) must be equal to the volumes not graded (c13) and graded (c14).
- Graded raw material is subsequently divided into 3 (or more!) grades. The weights are recorded from c15 to c 17.

Form 4: Production cost of finished goods

F4 is the core of the Cigar Box. It consists of an input output matrix multiplied by the corresponding prices for in- and outputs. In addition, it helps to monitor stocking levels and hence control unintended losses.

Cigar Box 3 – DAIRY PROCESSING		Production date "_01_" _July_2009						
F4a – Use of raw material and ingredients (VC1)								
№	Component	Dutch Cheese 45%	Yogurt 7.5%	Finished Product 3	Finished Product 4	Finished Product 5	Finished Product 6	
0	*Batch code*	***361***			***362***	***361***	***361***	
1	Raw milk (liters)	**800**			**900**		**400**	V
2	Skimmed milk (lt)	**200**			**-**	**7**	**73**	V
3	Cream 50% (kg)	**-**			**-**	**20**		V
4	Ingredient 4 (kg)	**-**			**9**			
5	Ingredient 5	**0.02**			**0.018**			
6	Ingredient 6	**0.4**			**-**			
7	Ingredient 7	**25**			**-**			
8	Ingredient 8	**4**			**-**			

Notes to F4a:

- All cost of form F4a got to VC1.
- The Word form should be used for maximally 6 finished products. If more products are produced additional forms must be used. The term finished products refers to products which leave the production process of that day. If tomato paste is produced for later manufacturing of ketchup, tomato paste is the finished product of that day. If the same day ketchup is made directly from raw tomatoes, then ketchup is the finished product.
- For each finished product the quantity of ingredients used is entered in the matrix. Preferably in kg, but if this is inconvenient, than in another unit, which should be indicated on the form.
- In the example above, ***batch 361*** was 1500 liters of milk used as follows:
    - 1200 liters not separated
        - 800 liter used for Dutch cheese 45%
        - 400 liter used for finished product 6
    - 300 liters were separated into
        - 280 liters of skimmed milk used for
            - 200 liter for Dutch Cheese 45%
            - 7 liter for finished product 5, and
            - 73 liter for finished product 6
        - 20 kg of cream
            - 20 kg used for finished product 5
- And ***batch 362*** was 900 liters, not separated entirely used for of finished product 4.
- The volumes between F1 and F4 must match; Use a check √ symbol, when this is OK.

Cigar Box 3 – DAIRY PROCESSING			Production date "_01_" _July_2009				
F4b – Packing of finished products (VC3)							
№	Packing material	Dutch Cheese 45%	Yogurt 7.5%	Finished Product 3	Finished Product 4	Finished Product 5	Finished Product 6
1	150 gram						
2	200 gram					135	
3	250 gram						
4	400 gram				1000		
5	500 gram						
6	1 liter PET bottle				485		450
7	Bulk in kg	85.21					

Notes to F4b:

- All cost of form F4b got to VC3.
- After processing raw material into the finished product it is packed. In this example Dutch cheese 45% is produced in round cheeses of 3.9 - 4.1 kg each. These are then stored for maturing and later repacked in 150 gram blocks or sold in bulk per kg. On July 1 21 cheeses were produced weighing 85.21 kg in total; no cheese was repacked that day.
- Finished product 4 was packed as follows: 1000 pieces of 400 gram and 485 bottles of 1 liter.

Cigar Box 3 – DAIRY PROCESSING				Production date "_01_" _July_2009							
F4c – Stock of finished products (10 SKU's)											
№	Item	Dutch Cheese 45%		Yogurt 7.5%	Finished Product 3		Finished Product 4		Finished Product 5	Finished Product 6	
0	Packaging	150 g	Bulk kg	250 gram	150g	500g	400gr	1lt PET	200 gram	500g	1lt PET
1	Opening stock		1245				0	0	23		0
2	Production		85.21				1000	485	135		450
3	Distributed / sold		100				900	485	115		450
4	Storage losses		0				0	0	10		0
5	Returned unsold		4				20	0	6		18
6	Closing stock		1234				120	0	39		18

Notes to F4c:

- The columns Finished Product are divided into the number of different packages as required. If more than 2 different SKUs exist per finished product, then the form must be adjusted and include only 5 or maybe even 4 different finished products per page.
- In this example the company sells 10 SKU's.
- On a daily basis stock information is entered per SKU.
- Storage losses must quantified in F9 – Other costs

Form 6: Cost of processing VC2
Form 9: All other costs

Cigar Box 3 – DAIRY PROCESSING			Production date "_01_" _July_2009						
F6 – Processing cost (VC2)					F9 – Other costs				
№	VC2 costs	Quantity	Price	Amount	№	Cost	Quantity	Price	Amount
1	Electricity	50	0.165	8.25	1	Storage losses (from F4c)	10 x FP5	0.825	8.25
2	Water	4	1	4.00	2	Automobile expenses			8.75
3	Diesel	10	2.8	28.00	3				
4	Food for workers			0.0	4				
5	Detergents & cleaning			0.0	5				
6	Spare parts (F8)			0.0	6				
7	Salaries for workers (F5)			0.0	7				
8				0.0	8				
			Total F6	40.25				Total F9	17

Notes to F6 and F9:

- All cost of form F6 got to VC2.
- All cost of form F9 got to daily overhead.
- In small enterprises it is customary for the head of production to enter rows 1-6 and leave row 7 (salaries) to the owner/general manager. Optionally, Salaries are recorded in F5 (not provided here).
- Storage losses from F4c must be entered in row 1 of F9.
- All other F9 cost can be entered at will.
- For SME's only the Total amount of F6 and F9 are entered into Excel CB3.

5.5 Assign Responsibilities and Systematize Information Processing

5.5.1 First time installation of CB3

After the owner/general manager has been convinced that the Cigar Box will be of use for his company he needs to organize training of his staff. This must be done by certified Cigar Box® trainer (see www.globalfacts.nl\cigarbox_partners.html for trainers in your environment). The trainer will gather company staff and explain the benefits of the system. Adapt data collection forms to the specific needs of the company and train users in filling them. Finally, consensus must be reached on the frequency of data entry and the time of delivery to the (central or de-centralized) computer where data are entered. The owner/general managers must endorse the assignment of these tasks and responsibilities.

The next task is to appoint a cost accountant, an 'Anushik', a person who understands cost-accounting and has the authority to obtain information throughout the company. It is important that the cost accountant has the ability and willingness to learn more about the underlying technological processes and has a basic understand of the equipment used in the plant.

The responsibilities of the cost accountant are:

- Ensure that forms are filled by the responsible person
- Ensure that the forms are delivered at the agreed hour
- Checking the forms
- Entering data into CB3
- Prepare reports

To facilitate selection of the Cost Accountant, the certified Cigar Box® trainer will prepare:

a. a profile of the desired capabilities;
b. a task description;
c. a time estimate.

Several candidates can be interviewed and pre-selected by the trainer after which the owner/general manager must endorse the choice and assign authorities.

5.5.2 After installation

Once the Cost Accountant has been appointed, the CB3 system has been installed, the forms distributed and staff has been trained, The cost accountant will start her/his daily tasks. Below is an example of 14-step information processing that is generally applied.

Figure 9 - Steps in daily implementation of CB3

SAMPLE FACTORY - CB3		
Step	**Activity**	**Responsible**
1	Fill in data collection forms	
	1. Pasteurised milk production - F3	Head of Dept 1
	2. UHT production - F4	Head of Dept 2
	3. Butter / ghee / curd production - F4	Head of Dept 3
	4. Powder milk production - F5	Head of Dept 4
2	Daily data entry into Excel	Cost accountant
3	Prices	Cost accountant
4	Verify results:	Cost accountant
	- recipe % and processing ratios in Technological Analysis Sheet	Technologist
	- variable cost % in Cigar Box	Cost accountant
	- gross margin % > 30%	Cost accountant
5	Mark questions on original data collection form in **RED COLOUR**	Cost accountant
6	Go to Department Head, ask reasons, write **CAUSES** on the (back of) data sheet.	Cost accountant
7	If no causes found, discuss with Factory Manager	Factory manager
8	Re-enter data, if needed	Cost accountant
9	Make daily printout	Cost accountant
10	Sign for approval, archive in special folder in the factory	Factory manager
11	Copy, Paste Special (Values and Formats, Transpose) to Database	Cost accountant
12	Update pivot tables and print out reports	Cost accountant
13	Send updated file to factory manager, general manager and/or owners	Cost accountant
14	Organize 1 or 2-weekly meetings with staff concerned to discuss deviations and results	Owner / general manager

Notes to Figure 9

- **Step 1**. Filling the forms in large companies is a shared responsibility; the cost accountant needs to be charged with sufficient authority to chase the responsible heads of department. In small companies the one-page data collection form must be filled (see paragraph 5.4.2).

  Step 2. Data entry in large companies can be done directly into CB3 Excel or into the new version of CB3 Access. In medium companies, data entry is the responsibility of the cost accountant. In small companies the director/owner will usually take this responsibility. Step 2 is further elaborated paragraph 5.6 Data Entry from Forms into CB3 Excel (for SMEs Only)

- **Step 3**. Before starting CB3 in Excel two price support tables are set up:
  - Prices of finished goods
  - Prices of inputs (raw material, ingredients, VC costs, packaging material)

  Most prices will not alter daily but the cost accountant must regularly verify prices with the accounts department of the general manager.
  A special case is the calculation of the prices of skimmed milk and cream after separation and the prices of the F&V grades after grading. The cost accountant needs special training for this.

- **Step 4**. After the data are entered, CB3 automatically calculates:
  - Processing ratios
  - Losses in kg and in %
  - VC1, VC2, VC3, gross margin and contribution for the production day
  - VC1, VC2, VC3 and gross margin per ton
  - VC1, VC2, VC3 as % of total VC

  Of all relevant parameters **benchmarks** must be calculated that will highlight if the result of the day is acceptable or not. The Cigar Box signals:
  Red light: problem!,
  Orange light: warning…
  Green light: we are OK!

- **Step 5**. When red or orange signals appear **deviation for the benchmark** occurred; the cost account must circle the data on the data collection form that are responsible for the deviation. This requires training and understanding of the technological processes as earlier described.
- **Step 6**. With the data collection form in hand, the cost account goes to the responsible people and verifies if maybe there was a writing error, if not ask for the **causes of the deviation**. **THIS IS EXTREMELY IMPORTANT!!** Without this information, solutions cannot be formulated and improvement cannot take place.
- **Step 7**. Because of the importance of listing causes of the deviations, the factory manager, or if need be the owner/general manager must be informed if NO CAUSES were found. He should gather his staff for a **crash meeting** and discuss the issue until a cause is found. If the deviation is important and frequently returning, outside help must asked for.
- **Step 8**. Re-enter data if needed.
- **Step 9**. Make a daily printout of the output tables. See instructions in paragraph 5.7.
- **Step 10**. The cost account should archive a signed copy, together with the original data collection forms in a separate CB3 folder in order of date.
- **Step 11**. After this has been done, the cost accountant copies CB3 F4 and pastes it in the CB3 F45 database. See instructions in paragraph 5.8.
- **Step 12**. Update the pivot tables (if any defined). This is not further elaborated in this manual.
- **Step 13**. Send the updated files, tables and what agreed upon to the factory manager, general manager and/or owners.
- **Step 14**. It is very important that the CB3 is not ‘working on an island’. In addition to the crash meetings mentioned in point 7, regular feedback must be provided to the staff responsible for data collection; they are also the people responsible for ‘production of the data’ and will appreciate it if improvements are measured.

5.6 Data Entry from Forms into CB3 Excel (for SMEs Only)

Data entry will be explained for the following forms: F1, F4, F6 and F9

5.6.1 Form 1 – Information on raw material intake

The form and the data input sheet are identical. See the forms below.

Figure 10 – F1 data input form in Word

Cigar Box 3 – DAIRY PROCESSING							Production date "_01_" _July_2009									
F1 – Milk Intake Form																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No	Time	Supplier	Price per liter	Volume in liters	pH	°C	Density	Weight in kg	Fat %	Fat in kg	Batch code	Milk not used for separation in liters	Milk used for separation			
													Milk separated in liters	Skimmed milk in liter	Cream in kg	Fat % cream
1	10:00	Ilhom	1.0	850	6.6	19	1.028	873	3.3	28.8	361					
2	10:00	Mutalib	1.1	650	6.3	25	1.026	668	3.3	22	361					
3				1500							361	1200	300	280	20	50%
4	18:05	Ilhom	1.0	400	6.7	18	1.027	411	3.6	14.8	362					
5	19:50	Markazi	1.0	500	6.6	22	1.027	514	3.6	18.5	362					
6				900								900	0	0	0	0
7																

There are two differences:

- The density 1.027 is entered as 27
- The total batch volume in rows 3 and 6 are not entered. Instead the batch totals are written in the record of the first supplier of the batch. The rest of the suppliers in the same batch are set to zero.

Figure 11 – F1-Database in Excel

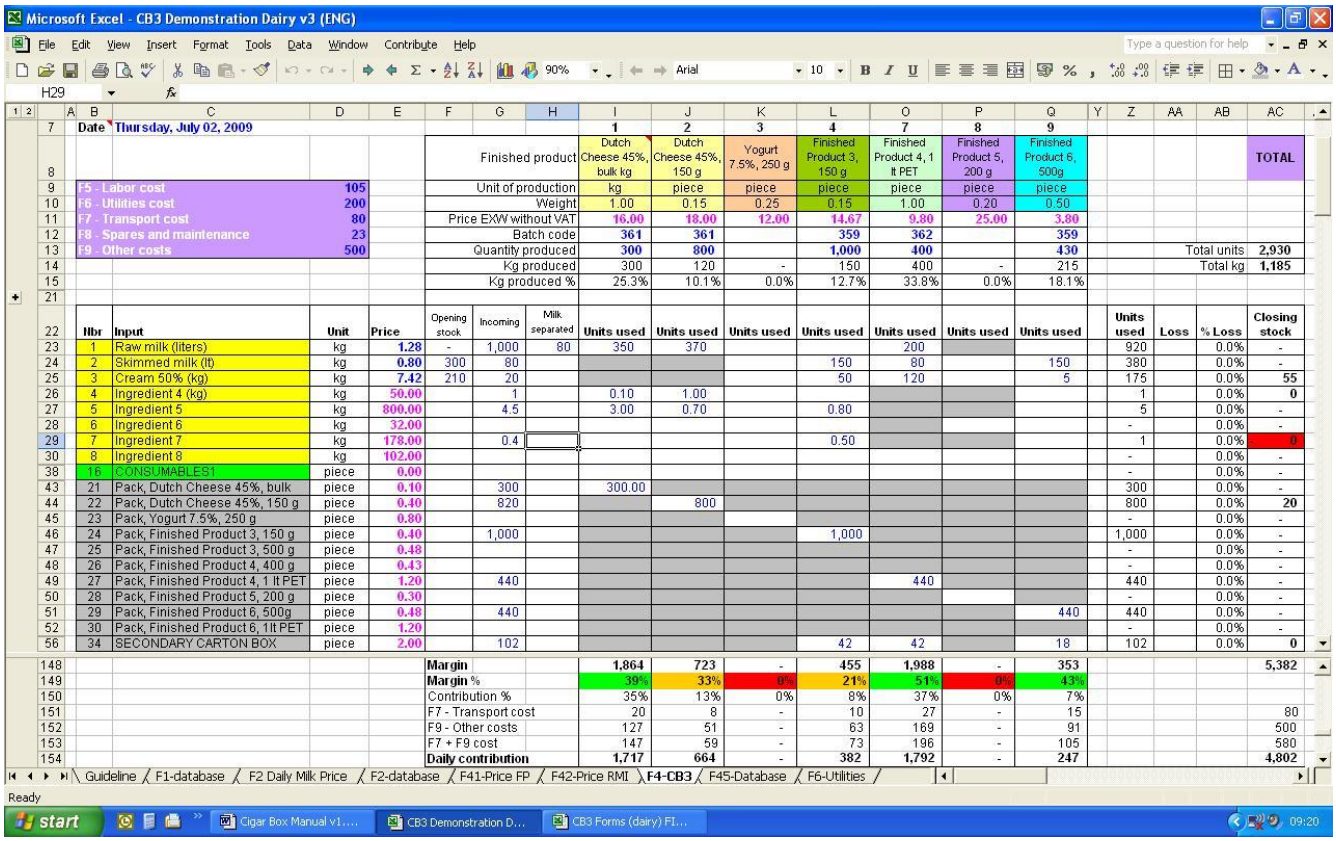
CB3 FORM 1 - RAW MATERIAL INTAKE AND CONTROL FORM

№	Date of delivery	Time	week	Name of supplier	Standard price	Q-ty in liter	pH	t°C	Density CLR	Milk kg	Fat %	Fat kg	Batch code	Milk not separated	Milk separated in liter	Skimmed milk in liter	Cream in kg	Cream %
1	01-Jul-09	10:00	27	Ilhom	1.00	850	6.60	19	28.4	874	3.3	28.8	361	1200	300	280	20	50%
2	01-Jul-09	10:00	27	Mutalib	1.10	650	6.30	25	26.0	667	3.3	22.0	361	0	0	0	0	0%
3	01-Jul-09	18:05	27	Ilhom	1.00	400	6.70	18	27.0	411	3.6	14.8	362	900	0	0	0	0%
4	01-Jul-09	19:50	27	Markazi	1.00	500	6.60	22	27.0	514	3.6	18.5	362	0	0	0	0	0%
5	02-Jul-09		27							0		0.0						
6	02-Jul-09		27							0		0.0						
7	02-Jul-09		27							0		0.0						

5.6.2 Form 4: Production cost of finished goods

F4 is the heart of CB3. In this form the cost of goods is calculated. It draws information from Form 4a, Form 4b, Form 4c, Form 6 and Form 9 and optionally from Forms 5, 7 and 8.

Figure 12 - Screenshot CB3 F4 Production cost of finished goods



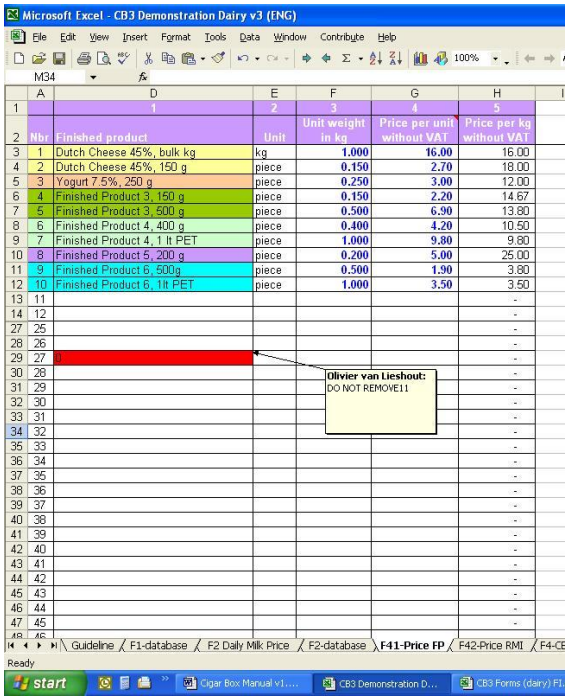
This screenshot shows a Cigar Box for 7 SKUs. SKUs 3 and 8 were not in production on July 2. SKUs 5, 6 and 10 are seasonal products and not produced at all in July, therefore they are hidden. As explained in CB2, products which a the same but packed differently receive the same color. This is just for convenience. So, there are two Dutch cheese SKUs, both light yellow. The screen is split in two: the upper part is for DATA ENTRY, the lower part shows MARGINS.

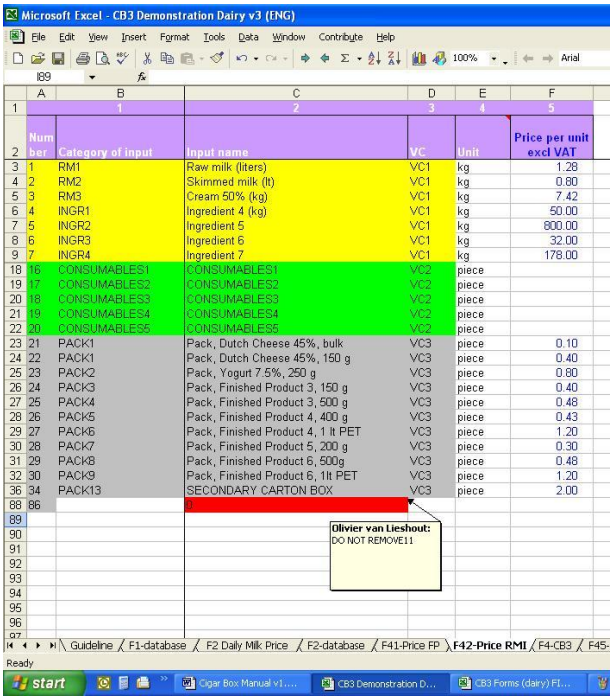
CB3 is further explained as follows:

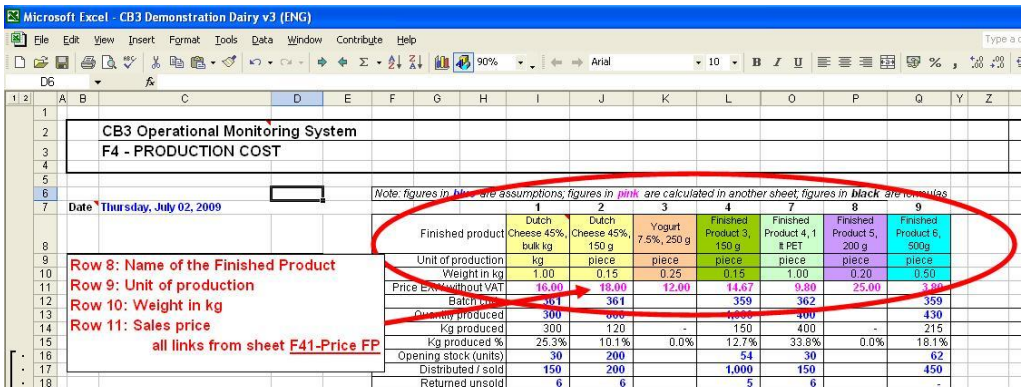
- DATA ENTRY is explained by means of 9 self-explanatory screenshots.
- DATA VERIFICATION is explained by 1 screenshot.
- DATA OUTPUT is explained by 4 screenshots.
- DATA ANALYSIS

5.6.3 Data Entry Screenshots

SCREEN SHOT 1 and 2 display the entry of the name, the unit, unit weight and price of respectively finished goods and inputs. These sheets have automatic links to sheet F4.

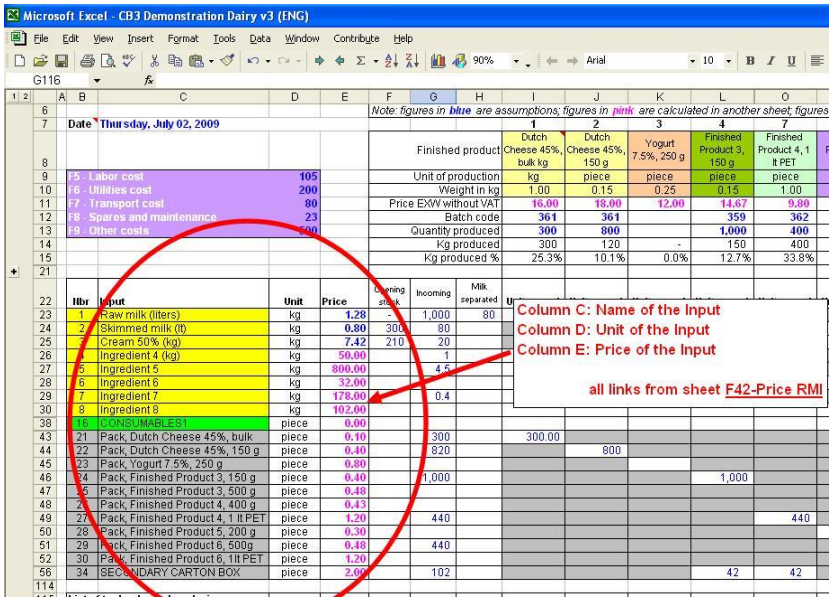






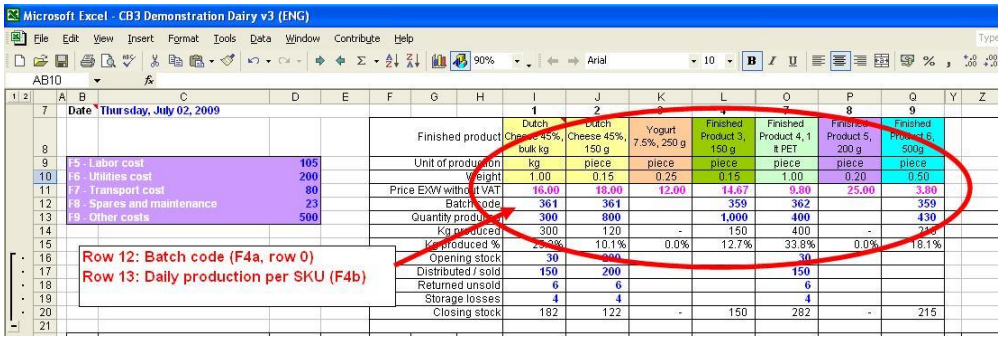
- **Row 8: Name of the Finished Product**
- **Row 9: Unit of production**
- **Row 10: Weight in kg**
- **Row 11: Sales price**

All links from sheet F41-Prices FP

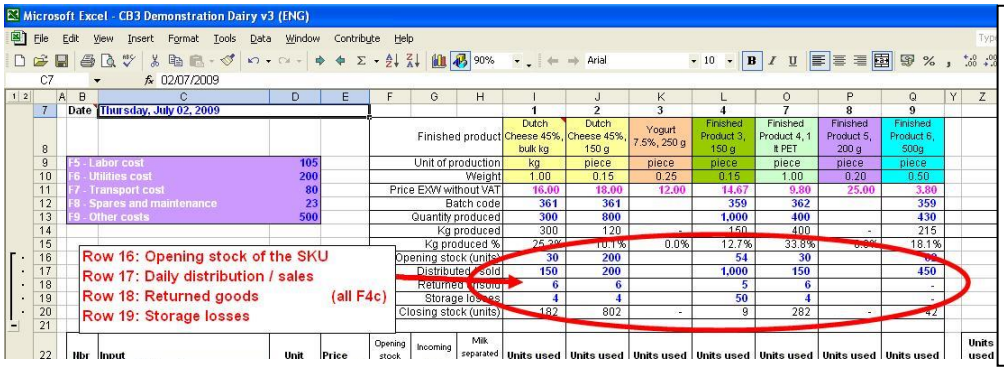


- **Column C: Name of the input**
- **Column D: Unit of the Input**
- **Column E: Price of the Input**

All links from sheet F42-Prices RMI

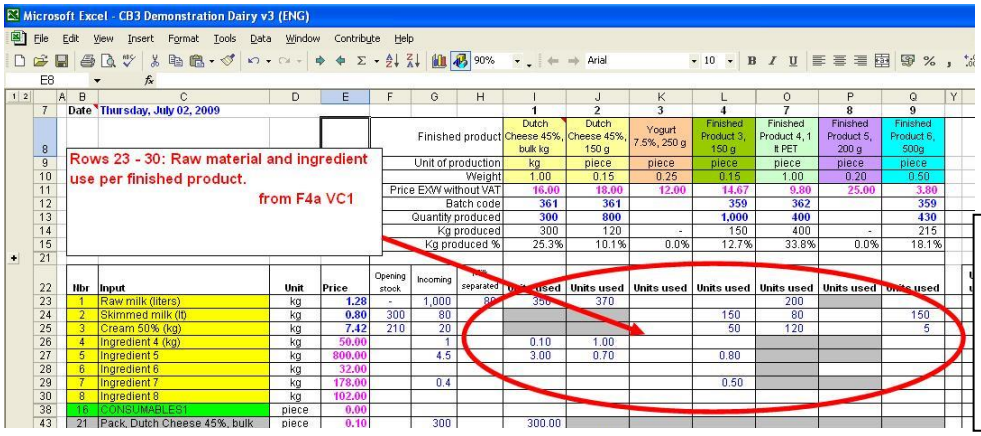


- **Row 12: Batch code (from Word form F4a, row 0)**
- **Row 13: Daily production per SKU (from Word form F4b)**



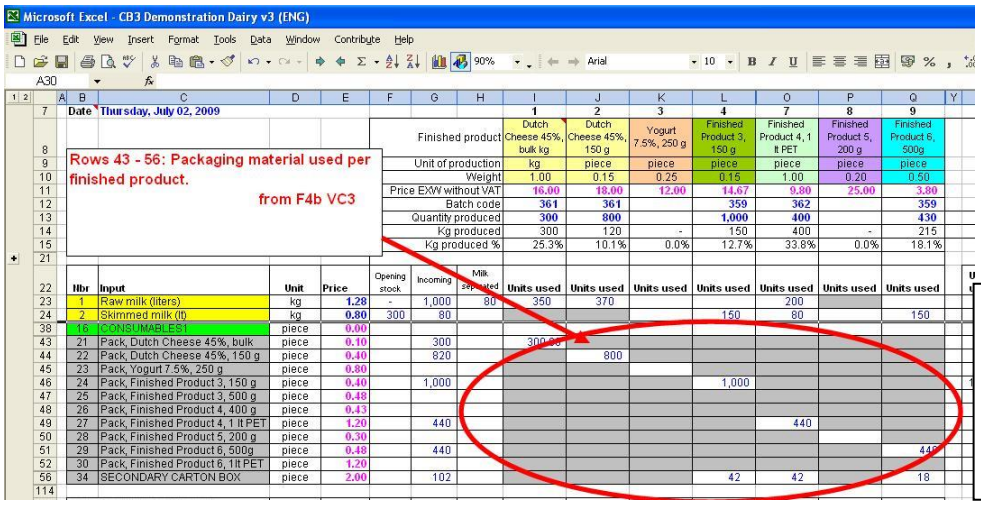
- **Row 16: Opening stock of the SKU**
- **Row 17: Daily distribution / sales**
- **Row 18: Returned goods**
- **Row 19: Storage losses**

All from Word form F4c



- **Rows 23-30: Raw material and ingredient used per finished product**

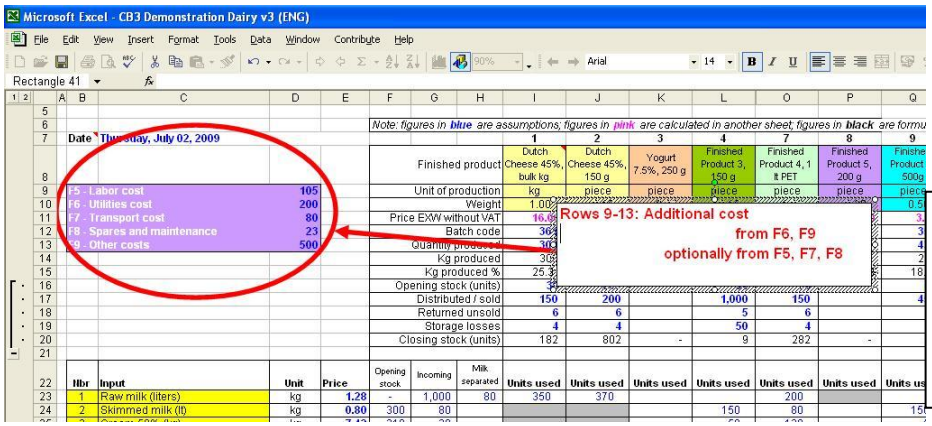
All from Word form F4a VC1



- **Rows 43-56: Packaging material used per finished product**

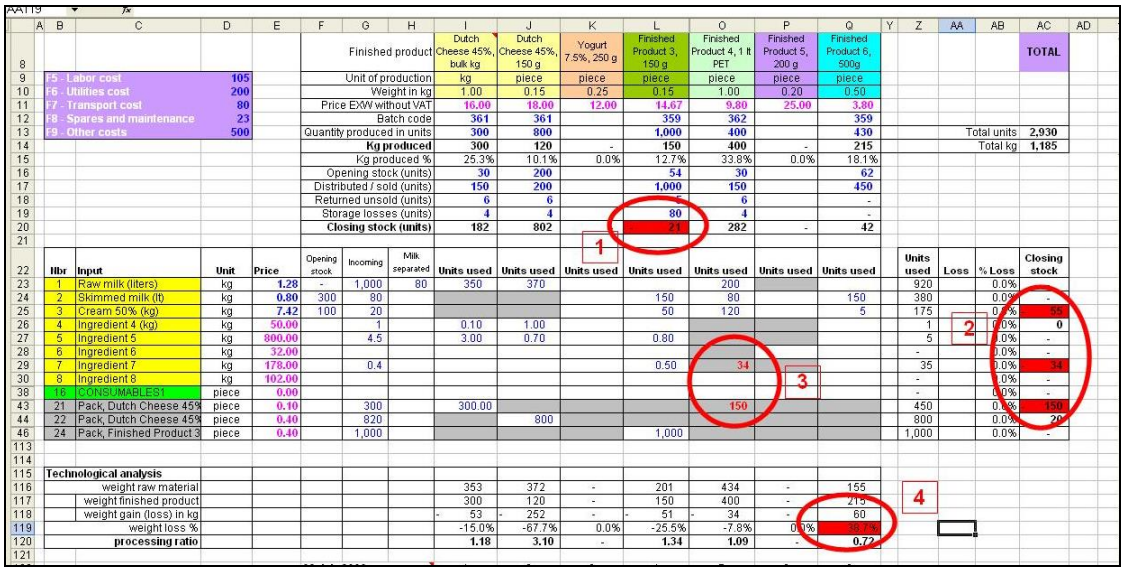
All from Word form F4b VC3

Form 6 and Form 9



5.6.4 Data Verification Screenshot

While entering data, red lights will appear if mistakes are made or impossible results are obtained. If red lights appear, data entry must be changed.



1. Stock of finished products cannot be negative.
2. Stock of inputs cannot be negative
3. Data may not be entered in grey boxes. The grey box have been colored deliberately to exclude data entry: e.g. the technologist indicated that skimmed milk and cream are never used to produce Dutch cheese, only raw milk is used for that. So, the area has been greyed.
4. The weight sum of all raw materials and ingredients, including water, cannot be more than the weight of the finished product produced.

5.7 Data Output Screen Shots

CB3 produces 4 tables automatically:

Table 5 - Technological analysis

Finished product	Dutch Cheese 45%, bulk kg	Dutch Cheese 45%, 150 g	Yogurt 7.5%, 250 g	Finished Product 3, 150 g	Finished Product 4, 1 lt PET	Finished Product 5, 200 g	Finished Product 6, 500g
Unit of production	kg	piece	piece	piece	piece	piece	piece
Weight in kg	1.00	0.15	0.25	0.15	1.00	0.20	0.50
Price EXW without VAT	96.00	120.00	12.00	14.67	9.80	25.00	3.80
Batch code	361	361		359	362		359
Quantity produced in units	35	226		1,000	400		300
Kg produced	**35**	**34**	**-**	**150**	**400**	**-**	**150**
Technological analysis							
weight raw material	353	372	-	201	400	-	155
weight finished product	35	34	-	150	400	-	150
weight gain (loss) in kg	- 318	- 338	-	- 51	-	-	- 5
weight loss %	-90.2%	-90.9%	0.0%	-25.5%	0.0%	0.0%	-3.2%
processing ratio	**10.22**	**10.94**	**-**	**1.34**	**1.00**	**-**	**1.03**

Table 6 - Daily cost of goods and margins per SKU

02 July 2009	**1**	**2**	**3**	**4**	**7**	**8**	**9**
Production value, Variable cost, and Margins per day	Dutch Cheese 45%, bulk kg	Dutch Cheese 45%, 150 g	Yogurt 7.5%, 250 g	Finished Product 3, 150 g	Finished Product 4, 1 lt PET	Finished Product 5, 200 g	Finished Product 6, 500g
Batch code	361	361	-	359	362	-	359
Opening stock in kg	**30**	**30**	**-**	**8**	**30**	**-**	**31**
Production in kg	35	34	-	150	400	-	150
Distributed / sold in kg	60	30	-	150	150	-	178
Returned unsold in kg	6	1	-	1	6	-	-
Storage losses in kg	4	1	-	8	4	-	-
Closing stock in kg	**7**	**34**	**-**	**1**	**282**	**-**	**4**
Production volume %	4%	4%	0%	20%	52%	0%	20%
P (EXW)	96.00	120.00	12.00	14.67	9.80	25.00	3.80
Sales value (EXW)	**3,314**	**4,075**	**-**	**2,200**	**3,920**	**-**	**570**
Cost of primary raw material	448	474	-	-	256	-	-
Cost of secondary raw material	-	-	-	491	954	-	157
Cost of ingredients	2,005	610	-	729	-	-	-
VC1	**2,453**	**1,084**	**-**	**1,220**	**1,210**	**-**	**157**
Consumables	-	-	-	-	-	-	-
F5 - Labor cost	5	5	-	20	55	-	20
F6 - Utilities cost	9	9	-	39	104	-	39
F8 - Spares and maintenance	1	1	-	4	12	-	4
VC2	**15**	**14**	**-**	**64**	**171**	**-**	**64**
Cost primary packaging	30	320	-	400	528	-	211
Cost secondary packaging	-	-	-	83	83	-	37
Cost auxillliary packaging	-	-	-	-	-	-	-
VC3	**30**	**320**	**-**	**483**	**611**	**-**	**248**
VC	**2,498**	**1,418**	**-**	**1,767**	**1,992**	**-**	**469**
Margin	**816**	**2,657**	**-**	**433**	**1,928**	**-**	**101**
Margin %	**25%**	**65%**	**0%**	**20%**	**49%**	**0%**	**18%**
Contribution %	14%	45%	0%	7%	32%	0%	2%
F7 - Transport cost	4	4	-	16	42	-	16
F9 - Other costs	22	22	-	98	260	-	98
F7 + F9 cost	26	26	-	113	302	-	113
Daily contribution	**790**	**2,632**	**-**	**319**	**1,626**	**-**	**- 12**

Table 7 - Cost of goods and margins per SKU per kg

Production value, Variable cost, and Margins per kg	Dutch Cheese 45%, bulk kg	Dutch Cheese 45%, 150 g	Yogurt 7.5%, 250 g	Finished Product 3, 150 g	Finished Product 4, 1 lt PET	Finished Product 5, 200 g	Finished Product 6, 500g
Sales price EXW	96.00	120.00	-	14.67	9.80	-	3.80
Average raw material price	1.27	1.27	-	-	0.64	-	-
Processing ratio	10.22	10.94	-	1.34	1.00	-	1.03
Cost of primary raw material	12.98	13.95	-	-	0.64	-	-
Cost of secondary raw material	-	-	-	3.27	2.39	-	1.05
Cost of ingredients	58.09	17.96	-	4.86	-	-	-
VC1	**71.06**	**31.91**	**-**	**8.13**	**3.03**	**-**	**1.05**
Consumables	-	-	-	-	-	-	-
F5 - Labor cost	0.03	0.03	-	0.03	0.03	-	0.03
F6 - Utilities cost	0.26	0.26	-	0.26	0.26	-	0.26
F8 - Spares and maintenance	0.14	0.14	-	0.14	0.14	-	0.14
VC2	**0.43**	**0.43**	**-**	**0.43**	**0.43**	**-**	**0.43**
Cost primary packaging	0.87	9.42	-	2.67	1.32	-	1.41
Cost secondary packaging	-	-	-	0.56	0.21	-	0.24
Cost auxillliary packaging	-	-	-	-	-	-	-
VC3	**0.87**	**9.42**	**-**	**3.22**	**1.53**	**-**	**1.65**
VC	**72.36**	**41.76**	**-**	**11.78**	**4.98**	**-**	**3.13**
Gross margin	**23.64**	**78.24**	**-**	**2.88**	**4.82**	**-**	**0.67**
F7 + F9 cost	**0.75**	**0.75**	**-**	**0.75**	**0.75**	**-**	**0.75**
Contribution per unit	**22.89**	**77.49**	**-**	**2.13**	**4.06**	**-**	**- 0.08**

Table 8 - Cost of goods as % of total variable cost per SKU

Variable cost components as % of VC	Dutch Cheese 45%, bulk kg	Dutch Cheese 45%, 150 g	Yogurt 7.5%, 250 g	Finished Product 3, 150 g	Finished Product 4, 1 lt PET	Finished Product 5, 200 g	Finished Product 6, 500g
Cost of primary raw material	17.9%	33.4%	0.0%	0.0%	12.8%	0.0%	0.0%
Cost of secondary raw material	0.0%	0.0%	0.0%	27.8%	47.9%	0.0%	33.5%
Cost of ingredients	80.3%	43.0%	0.0%	41.2%	0.0%	0.0%	0.0%
VC1	98.2%	76.4%	0.0%	69.0%	60.7%	0.0%	33.5%
Consumables	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
F5 - Labor cost	0.0%	0.1%	0.0%	0.3%	0.6%	0.0%	1.0%
F6 - Utilities cost	0.4%	0.6%	0.0%	2.2%	5.2%	0.0%	8.3%
F8 - Spares and maintenance	0.2%	0.3%	0.0%	1.2%	2.7%	0.0%	4.4%
VC2	**0.6%**	**1.0%**	**0.0%**	**3.6%**	**8.6%**	**0.0%**	**13.7%**
Cost primary packaging	1.2%	22.6%	0.0%	22.6%	26.5%	0.0%	45.0%
Cost secondary packaging	0.0%	0.0%	0.0%	4.7%	4.2%	0.0%	7.8%
Cost auxillliary packaging	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
VC3	**1.2%**	**22.6%**	**0.0%**	**27.3%**	**30.7%**	**0.0%**	**52.9%**
VC	**100%**	**100%**	**0%**	**100%**	**100%**	**0%**	**100%**

5.8 Data Analysis

CB3 makes use of two types of analysis: benchmarks using Conditional Formatting and pivot tables from the F45 database.

5.8.1 Benchmarks in the four output tables displayed above

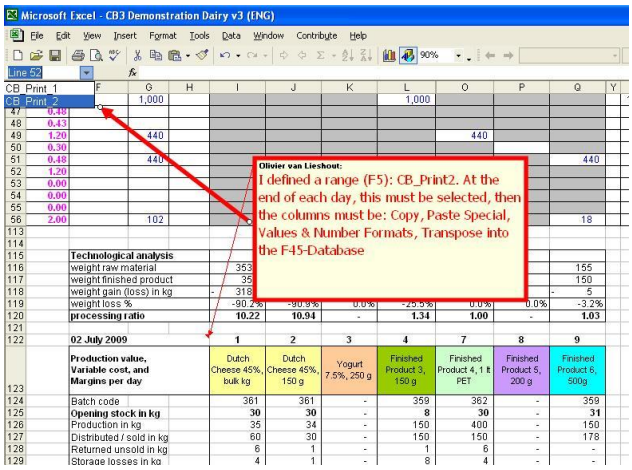
As explained in chapter 2, **benchmarks** are very helpful to quickly interpret the output tables and understand what was happening during that production day. To create a benchmark both international data and factory's own historical data are used. A minimum of two months (preferably 3-4 month) of data are needed to create meaningful benchmarks. The warning lights are created using Format | Conditional Formatting in Excel.

Red light: problem!,
Orange light: warning…
Green light: we are OK!

5.8.2 Data analysis using database F45

As explained in paragraph, a database is created in a separate sheet F45-Database. In four steps:

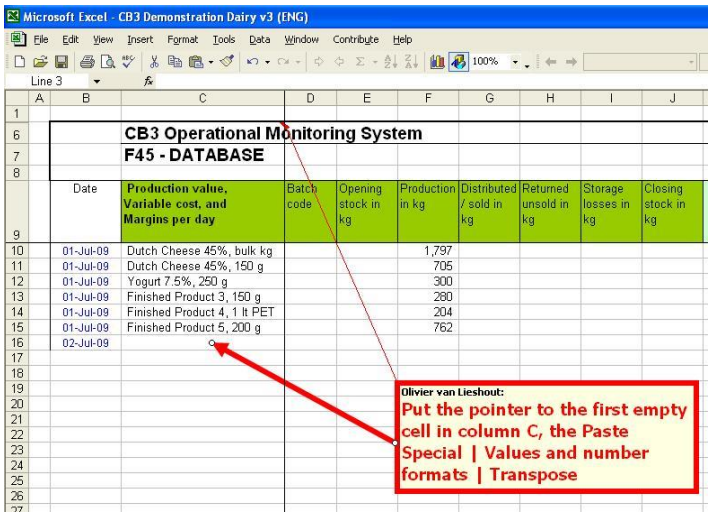
1. Select the pre-defined range (see screen shot)



I defined a range (F5) named CB_Print2. At the end of each day this must be selected, then the column must be Copied and Paste Special, Values and number formats, Transpose into the F45-Database

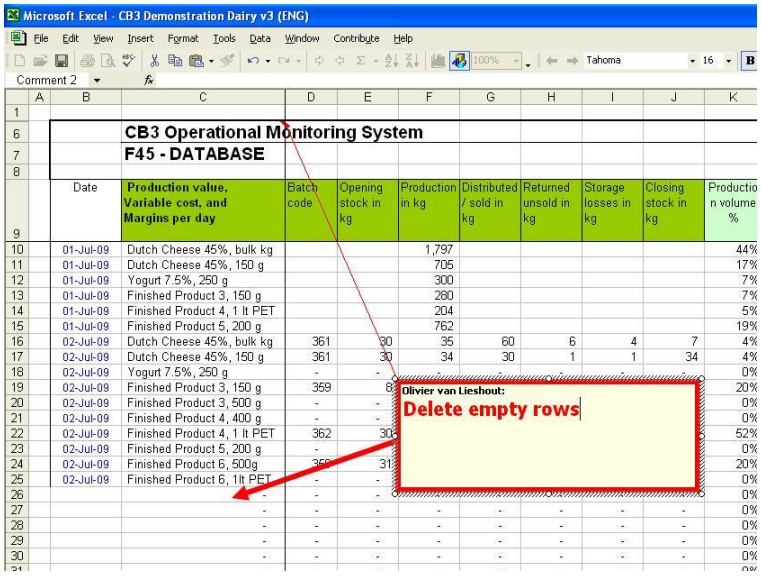
2. Copy this range

3. *Paste Special into F45-Database*



Put the pointer to the first empty cell in Column C, then Paste Special | Values and number formats | Transpose

4. *Delete the rows not needed.*



Delete empty rows

END OF DOCUMENT
29 July 2009
version 1.4.1