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**„THESES OF PH.D. DISSERTATION”**

**CANNING INDUSTRIAL RAW MATERIAL EXAMINATIONS  
IN TQM INTRODUCTION PROCESS**

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# CANNING INDUSTRIAL RAW MATERIAL EXAMINATIONS IN TQM INTRODUCTION PROCESS

## 1/ OBJECTIVE OF RESEARCH

It is generally known that the Hungarian canning industry is less able to manufacture products fully complying with the requirements of competitiveness, than earlier.

So today, in order to maintain this industrial sector, and catch the canning industry of the European Union up, it is essential to do researches which on the one hand exactly diagnose the present status of the canning industry, and, on the other hand, determine suggestions to help this industrial sector comply with the dominant challenges at the world market. Our theses aims to contribute to increasing the competitiveness of the canning industry and to help this industrial branch hold its position in the European Union with its modest means.

According to the above, **the actual purpose of my theses** has been wide-ranging:

a/ Determining **the quality of raw materials, the role of this quality among other factors influencing the production cost and the product complex quality**. In order to achieve this, specifying the **actual quality of certain raw materials** with measuring, and on the basis of this **the complex quality of the finished products, the losses during their production and the dependence of the effects upon the causes**,

b/ **Elaborating a proper solution to eliminate the main losses** (raw materials and others), to **improve the complex quality of the preserves, and to reduce the production cost** by the application of approach and attitude of TQM,

c/ Preparing a **TQM introduction model**, which is useful for the canning factories struggling with financial/operational problems as well,

d/ During the introduction of TQM, as the first project of this task, **introducing measures** eliminating the main losses, improving the quality and reducing the production cost, and **justifying the successfulness thereof** with measuring.

### **The general objective of my task:**

a./ Demonstrating that knowing **the logistics of raw material-supply, the canning industry using them, and the modern management methods**, in addition to the expedient **joint application** of these knowledge are such **effective tools in the hands of management**, which makes the operation of the canning industry as effective as possible.

b./ Proving to other canning factories that they can improve the operation by these application of modern methods on their own.

## 2./ PRELIMINARIES OF RESEARCH

The Hungarian canning industry has been fighting with economic crisis. In the last 15 years it has been less profitable than can be expected. In the middle of the nineties it was 5,4 % (Association of Hungarian Cannaries, 2000), while in 2002 – the average profit of leading cannaries was only 3,3 % (Vitez, 2003.)

The market importance of the formerly famous Hungarian canned products is today already slight. Their prices are far less than those of the competitors from the EU, and even e.g. the domestic, but French owned company named Bonduelle.

These factors are in direct correlation with the complex quality of the canned products and their production costs.

Therefore, **during my research I** studied a company fighting with operational problems, and **aimed to explore** the internal factors that affect the complex quality (safety, sensorical features) of canned products, and production costs in addition to the **possibilities** of the canning industry **to increase** efficiency, and thus **competitiveness**.

In the research work I have built upon my two-decade-practice as senior technologist, and manager of quality assurance in the canning industry. In the dissertation I present a summary of my five-year-research in the above field, highlighting the most important results.

At the beginning and during my work I have made efforts to get to know and follow the scientific results relating to my field, from which I have picked out the followings:

### Research analysing the competitiveness of the canning industry

For the **competitiveness** of the canning industry the followings are essential today: **guaranteeing the quality of the food** expected by the customer and **food safety** specified by law, **manufacturing food at the lowest** possible **production cost**, and **at the highest market-driven price** to maximize profitability, and last **the readiness of the enterprise to innovate**, i.e. the ability to apply the results of R&D in practice (Poderne,1991).

Among others, the main factors blocking the competitiveness of the Hungarian food industry are **the poor quality of agricultural raw materials** and **the high costs of producing food** (Lakner-Hajdune, 2002). This statement is true for the canning industry as well, whose production needs a large proportion of raw materials.

### Researches of raw material quality

**Changes in the quality of raw materials**, including the losses due to the deterioration until the starting of processing **have only been studied by few researchers** in Hungary, publishing their results mainly in the seventies and eighties. Considering these, without the purpose of

completeness, it is worth mentioning a study, which analysed the relationship **between the health status of tomatoes as a raw material and the quality and food safety parameters of tomato purée produced from it** (Boldogne, 1981). Other specialists examined the scheduling of harvesting (Mikecz, 1983), the lack of policy of certain plant types (Toma-Nagy, 1984), the loss of raw materials during storage (Nadasdine-Tothne, Fogarassyne-Nagy, Nagy et al., 1985), and the solution of accepting raw materials (Nadasdine et al., 1987).

In this industrial sector, the deterioration in the quality of the raw materials and thus the increase of the production cost are primarily caused by the **rather underdeveloped logistics of raw material supply** (Nadasdine, 2003).

On the contrary, **in Austria**, for example, which lays stress upon logistic aspects, **the route of the raw material from farm to the can takes only 40-90 minutes** (Törzsök, 1998). According to another illustrative data, while **in the French canning industry the loss of raw materials during the processing is 18 %**, it numbers **25 % in the Hungarian canning industry**. Consequently, to produce the same product, we need 9,3 % more raw materials than the French do. That leads to – depending on the raw material prices - several % higher production costs. The average added value in Hungarian food industry is 21 %, while in the EU it is 23 % (Piros, 2002).

#### Modern management methods for competitiveness

In order to fully understand the factors of competitiveness, the modern management methods could be of great help. This is supported by the excellent theoretical studies from the 1970s (Lado 1979, Susanszky 1982, Szilagyi 1986, Hoffer-Ivanyi 1990, Sosne 1996, Hajdune-Lakner 1999, Gyori 2002),, whose statements are also used in my thesis.

#### The results of the theoretical researches and the practice on the Hungarian canning industry

The **relationships of the factors of competitiveness** described above **are not sufficiently known to the Hungarian specialists and managers in the canning industry**. No indexes - that would be appropriate for measuring their own performance and comparing them with other producers' results - are prepared and assessed. As a result **the tasks for increasing quality and efficiency may not be realised**. The same applies to the adoption of the scientific results of the researches **on modern management methods**.

Thus, although excellent theoretical studies are available, they have not become reality in the canning industry. Consequently, an important correlation - stating that **the logistics of raw materials**, through the complex quality of raw material and canned food, **directly affects profits** - has not been realised.

### **3/ INTRODUCTION OF METHODOLOGY AND SITE OF THE RESEARCH**

#### **3.1/ Research methodology**

The chosen theme needs interdisciplinary approach, so the applied methods are as follows:

##### ***3.1.1/ Bibliographical research***

##### ***3.1.2/ Methods of data- and information- collection***

*3.1.2.1/ Measurements of closed cycle for disclosing the determinant losses:* handling of raw materials before processing, during storage, during production, during warehousing, packaging and loading.

*3.1.2.2/ Laboratory (sensorical and instrumental) tests:*

**For the raw material tests** I selected the following 4 raw materials (apples, tomatoes, sour cherries and cucumbers) from those processed by the factory under control, which:

- are processed on a large scale and by many factories,
- do not instantly get onto the processing line, but are temporary kept until processing.

**Tests on finished products:** I have only emphasised the control of the following parameters:

- parameters endangering food safety (e.g. patulin content, Howard.index),
- parameters showing the presence of conditions endangering safety (e.g. lactic acid content),
- parameters indicating the condition of organoleptic properties (e.g. taste, odour, texture).

*3.1.2.3/ Brainstorming:* Collecting ideas regarding the problems, reasons and solutions.

*3.1.2.4/ Customers' questionnaires:* these surveys reflect the customers' satisfaction with the product.

##### ***3.1.3/ Methods of data- and information analysis and evaluation***

*3.1.3.1/TOWS analysis:* regarding the treatment of the raw materials.

*3.1.3.2/ Calculation of losses:* regarding the mass of raw materials, or specified in HUF, on the basis of the performed tests (the handling of the raw materials, manufacturing and packaging /creating unit packages and unit loads, etc. processes/).

*3.1.3.3/ Statistical methods*

The parameters measured regarding the raw materials were evaluated with statistical methods in order to decide whether the **changes achieved** (the decrease of the losses) by 2000 and 2001 **are significant, that is due to the introduced measures**, as compared with the data, losses measured in 1999.

*3.1.3.4/ Pro and contra interactions:* for sorting out the best proposals.

*3.1.3.5/ Self-assessment of diagnostic purpose:* on the basis of the EFQM model, applying the **Tito Conti method**.

### ***3.1.4/ Introducing TQM***

Owing to the complexity of the range of problems undertaken, the solution needs a systems and profit oriented approach, **paradigm shift and new management methods**.

**Total Quality Management** is a system that is suitable for **handling the problems in an overall and complex way**. (TQM is a management system covering all the levels and operational processes of a company with profit-orientation, **aimed to improving the quality perceived by the customers and food safety, decreasing production cost, and improving competitiveness through the improvement of efficiency**.)

*3.1.4.1./ Improving processes:* I used the modified Tenner-deToro's method.

*3.1.4.2./ Logistics and other methods:* in the process for raw material handling.

*3.1.4.3./ Application of QACCP method:* for making better the quality of the products.

## **3.2/ Site of studies and experiments (Introduction of BEREG Ltd.)**

BEREG Ltd. is an export-oriented company; 80 percent of their canned products sold abroad. However, exporting possibilities have considerably been declining in the past 5 years. The change was especially dramatic at the Russian market, whose influence can still be felt. The company failed to build strong relations with the large food store chains in Hungary, to properly position the branded articles having been successful earlier, or to develop and introduce new products having their own image instead. Apart from the existing markets in Western Europe, it had not tapped into any new markets, could not adopt to the new circumstances. As a result, several aspects show that, giving up its former position, the Company gradually becomes an unknown canning factory manufacturing only mass products. In 1999-2000 the company produced a loss of nearly 2 billion HUF, and a state support of 1 billion HUF helped the company survive. BEREG Ltd. closed the year 2001 with a profit of some 30 million HUF. In 2002 the Company could realise a profit of approximately 90 million HUF without any state support, with a turnover of nearly 6 billion HUF. This **result is greatly due to** our efforts to decrease the losses based on the raw material control and to improve the quality with the application of the **TQM method**.

## 4/ OWN EXAMINATIONS AND MAIN STATEMENTS OF THE DISSERTATION

### 4.1./ Examining the quality and the production cost, possible solutions in the cannery

#### 4.1.1/ Raw material-situation in the canning industry

*Figure 1* schematically shows where the factors affecting quality, production cost and competitiveness stem from.

As it is shown, **the main proportion of the qualitative and loss factors** of the canned products **originate from outside the factory**, from the cultivation and the subsequent operations.

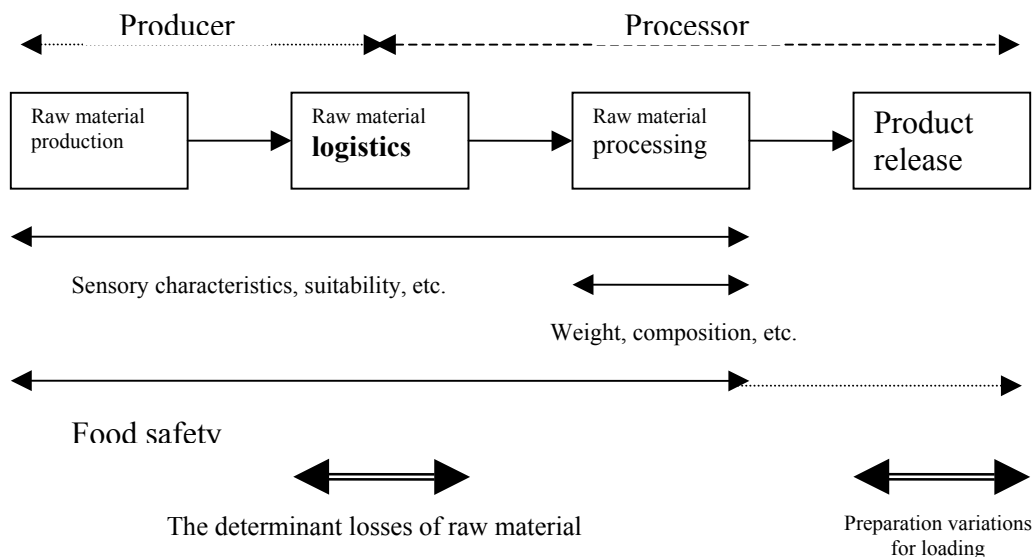


Figure 1: Places of origin of the quality and loss components of canned products

These are accompanied by the **operations inside the factory:** temporary storing, sorting prior to processing, which all influence the quality and the production cost.

According to the above, it can be established that **the quality of canned products crucially and typically depends upon the raw materials, and thus is strongly determined by the production and logistics of raw materials.** Consequently, if we would like to improve the important components, i.e. the quality and production cost of the competitiveness of canned products, we should start our work with the raw materials.

Reasons for **raw materials of low quality<sup>1</sup> perceived in the phase of processing:**

- faults of the cultivation technology (inappropriate plant protection, etc.)
- faults of the technology of harvesting, if timing is inappropriate from the aspect of food safety waiting times, or if **damaged pieces get among the raw materials of good quality**, although they could be removed.
- logistic problems: **the processing company does not schedule** the harvesting and the subsequent **delivery**, at best they issue delivery licences, at time of raw material dumping.
- faults during qualitative reception: the raw materials' requirements are often kept formally.
- raw material prices do not incite to high quality. The determining and the changes of the prices depend on various factors. E.g. the producer reduces the excessively high price by applying deductions or diverting the price to be paid from the announced price in other ways.
- in order to establish the continuous operating conditions of the processing lines, at the factory-yard usually a stock of raw materials for several days are collected.
- during storing the quality of raw materials is not checked, and thus the changes therein during storing have no influence on the order of processing the lots.

These operations determine or influence the following:

- during cultivation the pollution of the raw material with chemical agents such as artificial fertilisers, sprays or weed-killers, and the health status.
- the harvesting determines or its time influences:
  - the ratio of damaged raw materials remaining in the lot, which is the basis for the quantities of different harmful substances (patulin, mould, etc.),
  - the future rate of rotting during storing before processing,
  - the future loss of sorting before processing, etc.
- the temporary storing before and after reception of raw materials determines or influences:
  - the ratio of damaged raw materials remaining in the lot, that causes the future content of harmful substances in the finished product,
  - the quantity of the raw materials actually sorted, that is the proportion of the loss.
- during processing, although the content of harmful substances can further increase or the organoleptic properties can decline, this operation is less decisive regarding the quality and the production cost of the canned products.

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<sup>1</sup> The low or poor quality of raw materials has been determined according to the EU conform requirements set forth in Volume I of the Hungarian Directives on Food on the raw materials consumed freshly, These form the basis of elaborating the Domestic Standards on the raw materials of canning factories.

The **quality and production cost of the canned products** crucially and typically depend on raw materials, and so are **determined by the raw material cultivation and –logistics** according to the above. Consequently, if canning companies want to improve the key factors – complex quality and production cost - of competitiveness, the work has to be started with the raw material.

Summarizing: the raw material of poor quality affects harmfully the followings:

- sensorical features of canned products (e.g. rotten after-taste, or characterless taste), or
- food safety, deficiency of which (e.g. several harmful material contents over the accepted limits, makes food unsuitable for human consumption, or
- the quantity to be sorted out, i.e. the wastes of raw material origin.

#### ***4.1.2/ Complex quality of the finished product***

Starting from the concept that the quality of the finished product is determined by the customer, we specified its conformity on the basis of customer surveys. Based on the fact that food safety can be realised by fulfilling certain prescribed parameters<sup>2</sup>, we related the values measured in the products to the prescriptions thereof.

**Our surveys have justified the former statements saying that these are mainly determined** by the health status of the raw materials at the time of getting onto the processing line, that is the **“logistics” of purchase.**

#### ***4.1.3/ Improving the quality of raw materials by applying TQM***

On the basis of points 4.1.1. and 4.1.2. it is necessary to improve the raw material logistics. Considering raw materials, the problems are so serious and the “business-as-usual mindset” are so ingrained that they **cannot be changed** with the traditional approach, **with the management methods applied until now.** In order to find a solution, the following aspects jointly shall play a part:

- the physical, chemical, microbiological and organoleptic controls of raw material, in relation to the similar tests of the finished products prepared from them,
- utilisation controls with closed cyclic measurement,
- quality management system (with system- and process approach/attitude),
- knowledge on plant organisation, company economics, etc.,

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<sup>2</sup> Such prescribed parameters are e.g. regarding tomato purée: Howard index, apple concentrate: patulin content.

- and the synthesis of the above, the holistic, **system-attitude**, which aims to find the correlation between the measured or experienced parameters and the applied practice, and having found them, to determine and realise the tasks.

It has been proven that TQM is excellently suitable for completing this complex tasks.

#### **4.2/ Creating a new TQM introduction model**

In order to create the model, I first of all studied and compared the published TQM introduction models to find the common and the unique properties. After this, a synthesis of the steps was necessary with the help of which I could prepare my new model.

*The model was prepared for companies struggling with financial (and operational) problems*

According to my model, **the introduction of TQM consists of two phases, *In Phase 1*** the operational disorders of the company are identified, and we only concentrate on eliminating **the most serious** problem. This is the production that costs too much and does not comply with the expected quality, which is usually caused by the considerable loss of the raw material and the packaging. In such cases **the financial indexes must be improved.**

*Phase 2* of the introduction of TQM may start after the stabilisation of the company status in Phase 1. Otherwise Phase 1 must be repeated.

#### **4.3/ Testing of Phase 1 of the new model**

Considering the steps **in Phase 1 of the TQM introduction**, the following is introduced here:

- Self-assessment of diagnostic purpose (steps 7 and 16 of the TQM introduction model, Theses, point 4.3.1)
- Specifying the position of raw material losses among the different types of sources of loss. (step 10 of the TQM introduction model, Theses, point 4.3.2),
- Identifying the processes and criteria of success related to making a loss and the establishment of the product quality (steps 11-12 of the TQM intr.model, Theses point 4.3.3.),
- Developing the processes, proving the improvement with measurements, and the improvement of the key results (step 13 of the TQM introduction model, Theses, point 4.3.4).

***In Figure 2***, together with Program I of the TQM introduction, **as a summary, I present the core, the steps and the details of the work performed during the introduction..**

Figure 2. Implementation steps, tools, methods, results and completed documents during implementation of TQM model

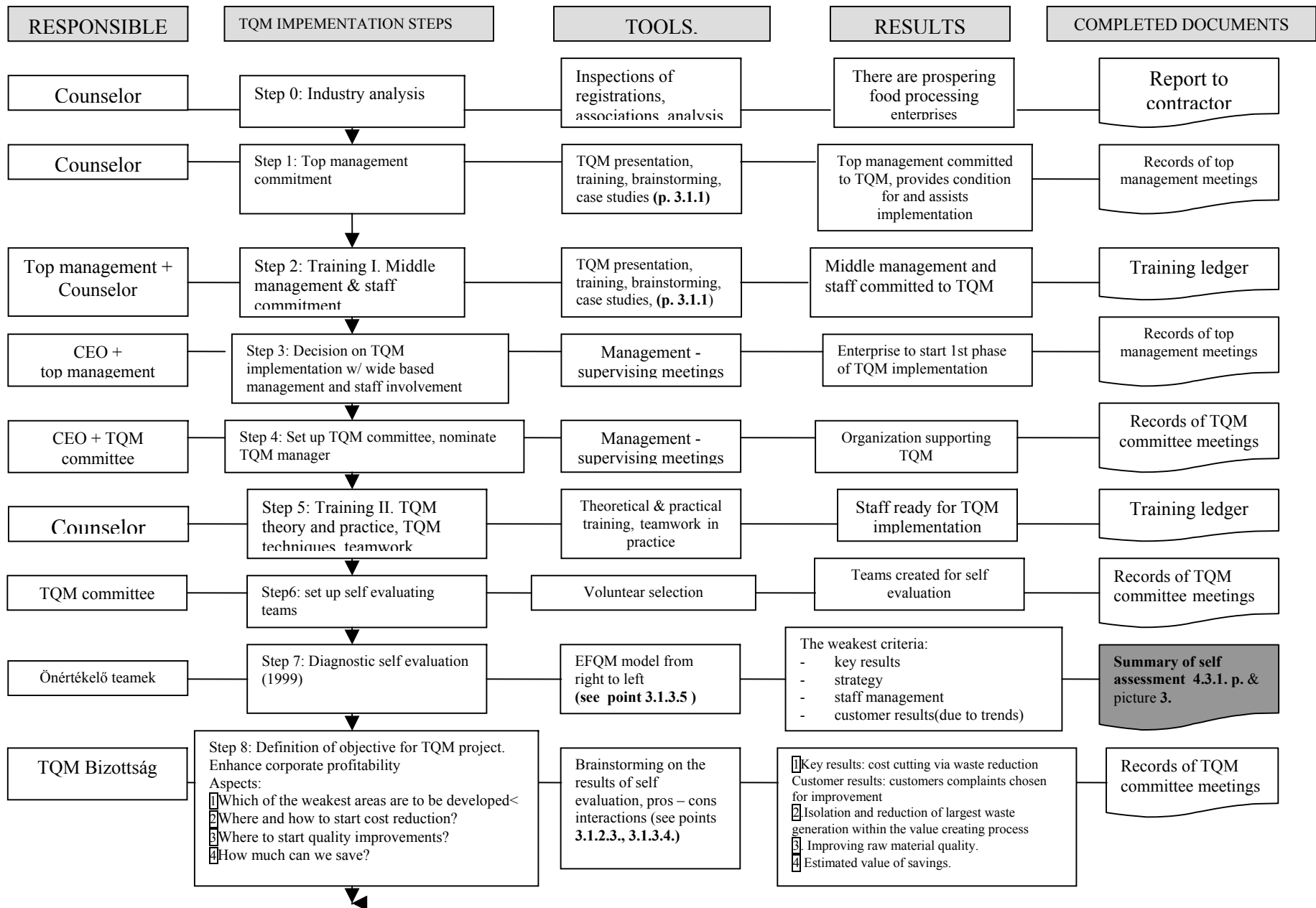
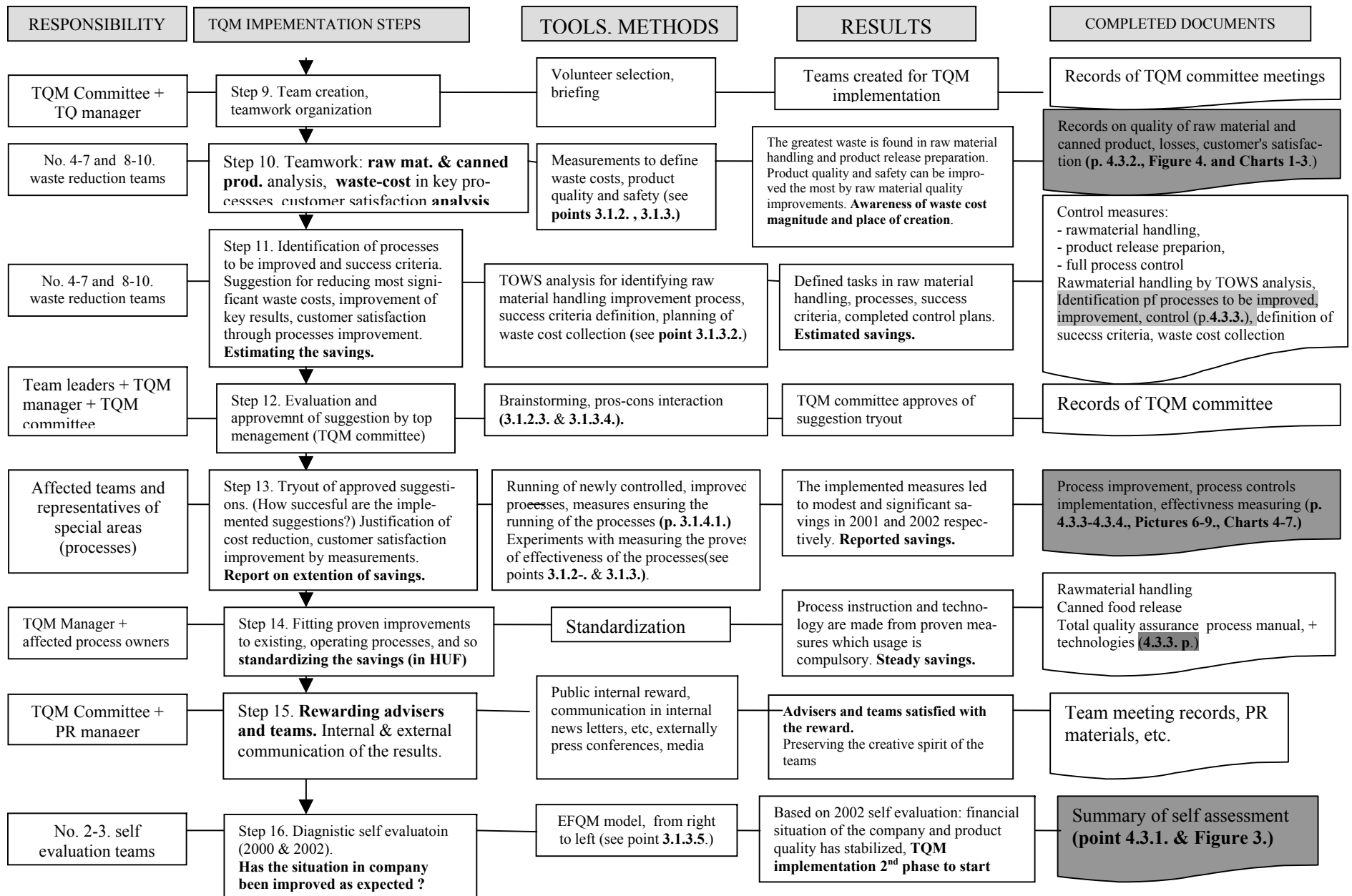


Figure 2. Implementation steps, tools, methods, results and completed documents during implementation of TQM model (continued)



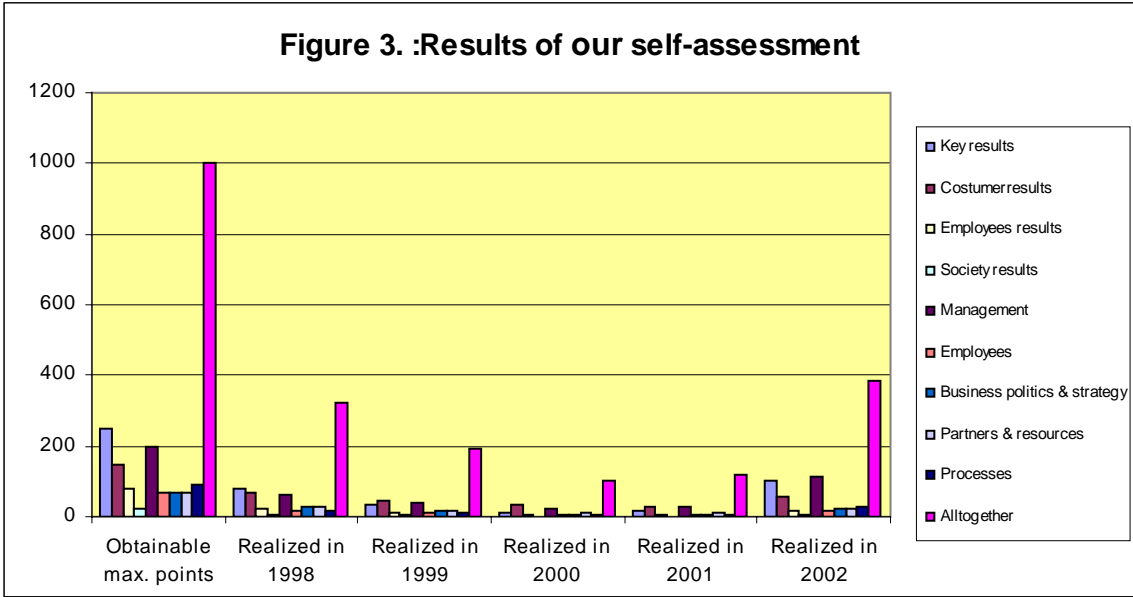
I have marked the **documents** introduced in the thesis in order to make the thoughts and the sequence of work easy to follow.

Key to the signs used:

- Steps, means, results, documents of the introduction of TQM
- Out of them, those introduced in the thesis*

**4.3.1/ Results of the diagnostic self-assessment**

I present the results of the diagnostic self-assessment of 1999-2001 in a summary, which also includes the results of 1998 for the sake of comparison. Based on the data of the self-assessment of 1999, we concentrated on the **improvement of the key results** and the **customers’ satisfaction**. The summarised results of self-assessments are shown in *Figure 3*.



**In Phase 1 of the TQM introduction model** the results improved only in a few criteria, and in some cases they stagnated due to the disadvantageous circumstances. In several cases the results could not reach the level of 1998. The scores of Management remarkably increased in 2002. However, this is not the result of the actual performance yet, but it rather expresses the intensified expectations and trust.

### 4.3.2/ Determining the losses and the quality of the products

4.3.2.1/ The series of measurements aimed to find out how the quality of the raw materials / finished products changes, and where the largest *losses*<sup>3</sup> develop in the value producing process. See *Figure 4.* for the place of the measurements and losses, and *Table 1.* for the values measured.

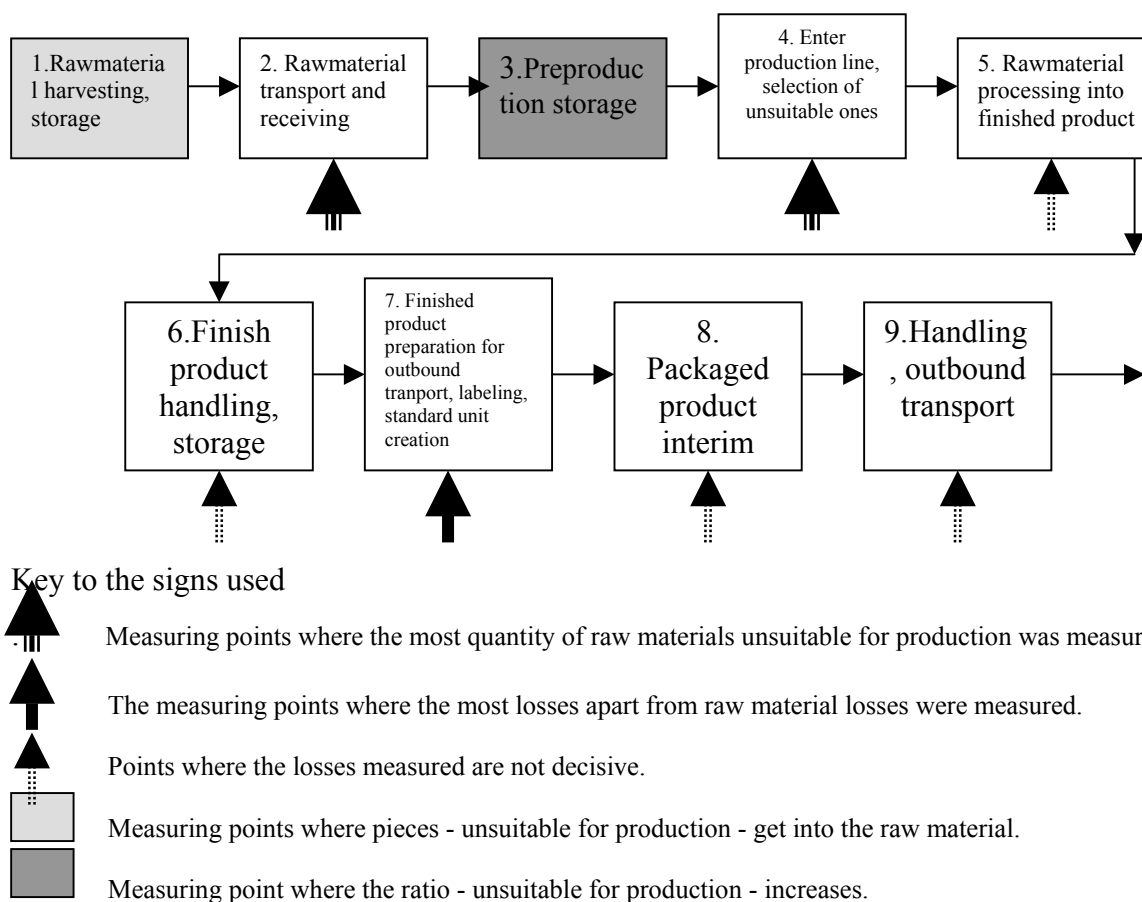


Figure 4: Main processes of manufacturing with areas where most losses are created

Table 1.: Areas and levels of annual losses in the value creating processes

Total annual loss in 1999	Raw material loss created in step 1-3. as measured in step 4.	Raw material loss created in steps 5-9 <sup>4</sup>	Time and capacity loss in steps 7-9.
- Cherries (HUF)	24.242.400	4.460.602 (18,4 %) <sup>5</sup>	
- Cucumbers (HUF)	9.922.500	1.339.538 (13,5 %) <sup>4</sup>	
- Tomatoes (HUF)	31.600.800	4.139.705 (13,1 %) <sup>4</sup>	
- Apples (HUF)	73.742.000	2.359.744 (3,2 %) <sup>4</sup>	
<b>Total raw material loss(HUF)</b>	<b>139.507.700</b>	<b>12.299.589</b>	
<b>Packaging loss (HUF) (due to variation in product release)<sup>6</sup></b>			<b>30.797.888</b>
<b>% of annual revenue<sup>7</sup></b>	<b>1,7 %</b>	<b>0,15 %</b>	<b>0,38 %</b>

<sup>3</sup>Raw materials include e.g. the processed form of sour cherry, apple, etc., that is when summarising losses, no difference is made between the raw sour cherry, etc. and the stoned, heat-treated, etc. sour cherry. When specifying the deficit in HUF, we indicated the total sour cherry, etc. loss, and calculated at the price of raw materials from 1999.

<sup>4</sup> Do not make any differences between the losses of real raw material, and the raw material under processing, or processed.

<sup>5</sup> We considered 100%- the given raw material losses measured in the actions 1-3.

<sup>6</sup> This is not a subject of this article, it solves only as basis for comparing. These losses are namely the losses because of many variations of packaging units, loading units, etc. in Ft.

<sup>7</sup> Compare with the profit in the canning industry between 1994-1997, which was 5,2 %-.

The largest losses and their places of origin determined as a result of the measurements:

- loss of raw materials as a result of handling before processing (input),
- losses of work time and capacity, losses due to the higher stocking of packaging materials during the operations related to the output.

4.3.2.2 The complex quality of the products was determined by labor testing and measuring the customers’ satisfaction in a diagnostic self-assessment. The result of the measuring showed that in 1999 42 % of our customers thought that the complex quality of our products was good, but variable.

**Summarizing point 4.3.2.:** connection among the raw material logistics – losses - complex quality of canned products – competitiveness is shown in **Figure 5.**

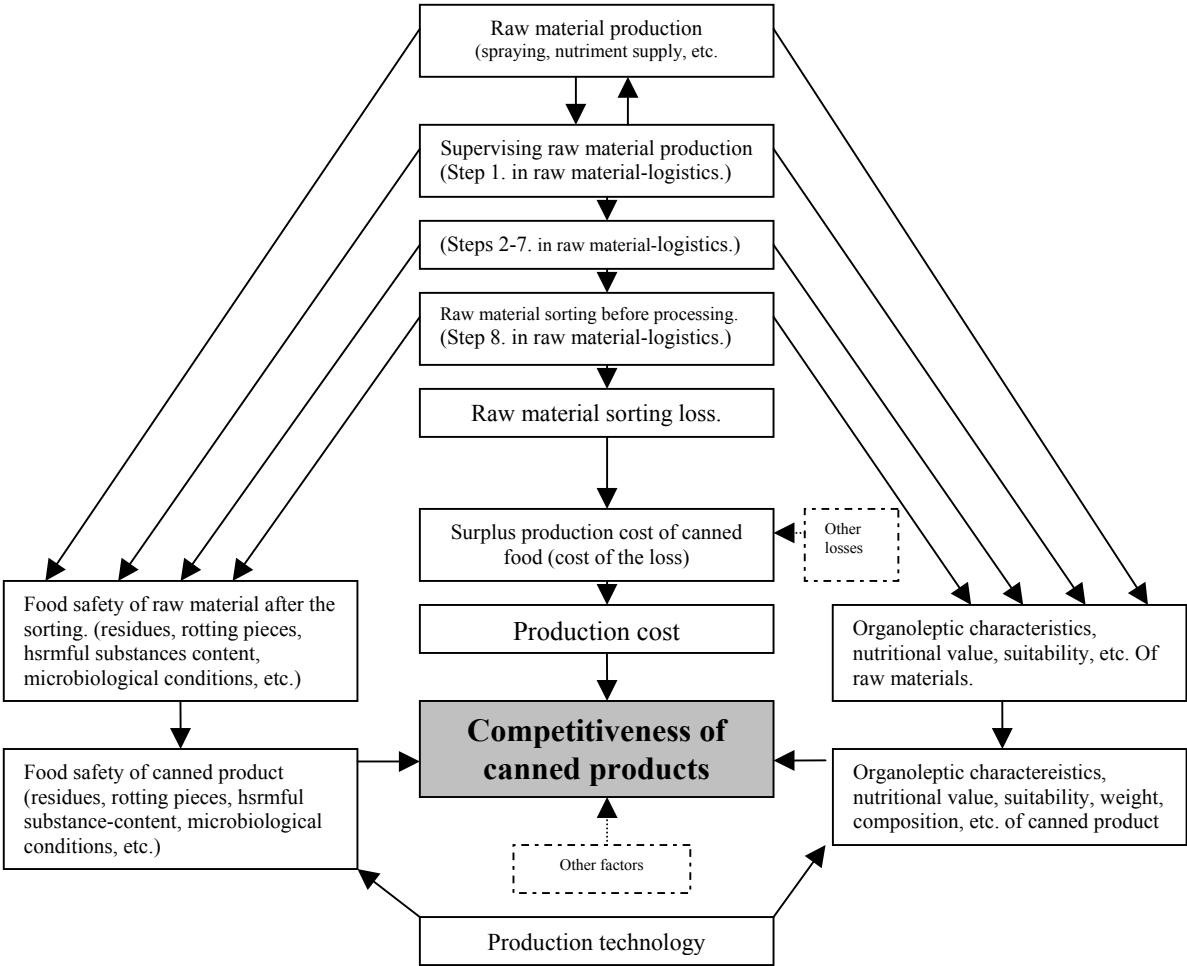


Figure 5. Relation-diagram among raw material logistics and competitiveness  
 4.3.3/ Identifying and improving the processes related to creating losses and quality

Based on the above statements, **I prepared and tested my suggestions for the reducing of losses and improving the given processes, utilising the opportunities of the TQM method and approaches.** This method also formed the basis for **controlling the effective operation of the improved processes by measuring.**

Using this method it was determined that an important **reason for the high losses** is that **the activities involved are not organised into process(es), but belong to different functions, and thus they have no specialists in charge of the processes. No indexes were created for the effectiveness of the processes, and thus they are not measured.** Furthermore, the processes of handling (logistics) the raw materials and the output (packaging) processes reach beyond the organisational unit and even the canning factory. The supplier and the customer were not involved in a proper systems approach. Moreover, the activities performed within the factory such as the acceptance of the raw materials, the temporary storing before processing, the repeated quality control<sup>8</sup>, sending the raw materials for processing, and sorting them on the production line, did not comprise a single process, and thus they were **no proper attention was paid, keeping the final goal in mind.**

High losses and deviation in quality as problem areas were **solved with the method of process improvement** in team work. The steps of this activity are as follows:

#### **4.3.3.1/ Decreasing the largest losses with the method of process improvement**

**Step 1: Identifying the problem:** It was the high production cost.

**Step 2: Identifying the involved processes:**

**“A” Input process:** The process of raw material handling from the harvesting until the sorting out on the processing line, which consists of the following actions:

scheduled **harvesting – delivery – acceptance – temporary storing – repeated quality control – delivery on production line - sorting on production line.**

**“B” Output process:** Preparing the canned food for distribution, starting from the packaging until loading. (**designating for packaging – sending to packaging – creating unit packages and unit loads – temporary storing – loading**).

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<sup>8</sup> This activity was totally missing prior to my researches, and thus the order of processing was determined by the attitude of the drayman instead of the status of the raw materials.

**Step 3: Measuring of losses<sup>9</sup>:** The measurements were performed in the proper operations of the processes identified in Step 2 of the process improvement. With the measuring series carried out in 1999, we determined the bases of comparison (raw material parameters and loss values specified in HUF), which later (in 2000-2001) helped specify the extent of the improvement. (The results of the earlier measurements, together with the results of 2000 and 2001 can be seen in Step 5, in **Figures 6-9**, and the results of the latter measurements **are summarised in Tables 2 and 3.**)

Table 2.: Losses in raw material handling in HUF

	Inherent at receiving	Created through storage	Total waste
Apples	48.935.558 (66 %)	24.906.442 (34 %)	73.742.000 (100 %)
Cherries	7.109.208 (29 %)	17.133.192 (71 %)	24.242.400 (100 %)
Tomatoes	12.898.285 (41 %)	18.702.515 (59 %)	31.600.800 (100 %)
Cucumbers	762.097 (8 %)	9.160.403 (92 %)	9.922.500 (100 %)
<b>Total annual loss due to raw material unsuitable for production</b>	<b>69.605.148 (50 %)</b>	<b>69.902.552 (50 %)</b>	<b>139.507.700 (100 %)</b>

Table 3 Total losses due to variation in product release in HUF

Type of measured losses	Calculated losses based on measurements (HUF)
<b>Total annual release losses</b> (due to variation in packaging) /calculation based on data taken in 10 shifts/	<b>30.797.888</b>

**Step 4:** Knowing the annual loss expenses from 1999 of the identified “A” and “B” processes, the teams **developed solution suggestions.** Their essence is: the activities should be organized into processes, and they should be regulated and continuously managed.

**The essence of proposals in case of “A” process:**

- a very close and mutually advantageous co-operation with the raw material producers is necessary (harvesting in proper quality due to the scheduling)
- a raw material dispatcher is required, who is in charge of keeping contact between the raw material producers and the canning factory for the sake of scheduling the harvesting and the delivery of the raw materials,

<sup>9</sup> Step 3 of the process improvement described by Tenner-deToro is the Measuring of performance. However, in the process of handling raw materials, I introduced and tried the Measuring of losses instead. During the process improvement in practice this solution served effectiveness, that is the decreasing of the losses emerging in the process well.

***The essence of proposals in case of “B” process:***

- a much closer co-operation is required with the customers as well (due to the discussing, standardising of the ways of packaging, timing of delivery, etc.),
- a person in charge of planning and organising the packaging and delivery is necessary, who keeps contact between the customers and the canning factory considering the frequent resetting of lines, the stocks of packaging materials, the reducing of packaging variations, and the scheduling of deliveries, etc.

***Step 5: Accepting and trying the suggestions, managing “A” and “B” processes and taking measures helping the operating thereof.<sup>10</sup> Carrying out monitoring controls justifying the efficiency and efficacy of the improved processes.***

⇒ We introduced the suggestions with a temporary effect in 2000-2001. We promoted the successfulness of their testing with the following measures:

**“A” process:** a./ **We invited our raw material producers** in January 2000 and then every January, and **informed them** on the quality expected by us, the way of realising this quality, the importance of scheduling the harvesting and the immediate transporting to the factory, etc.

b./ a raw material dispatcher has been created, who is in charge of scheduling the harvesting and the delivery of the raw materials,

c./ instructions for quality acceptance, store, handling, protecting, transporting to the processing line, and sorting of raw materials have been elaborated and introduced.

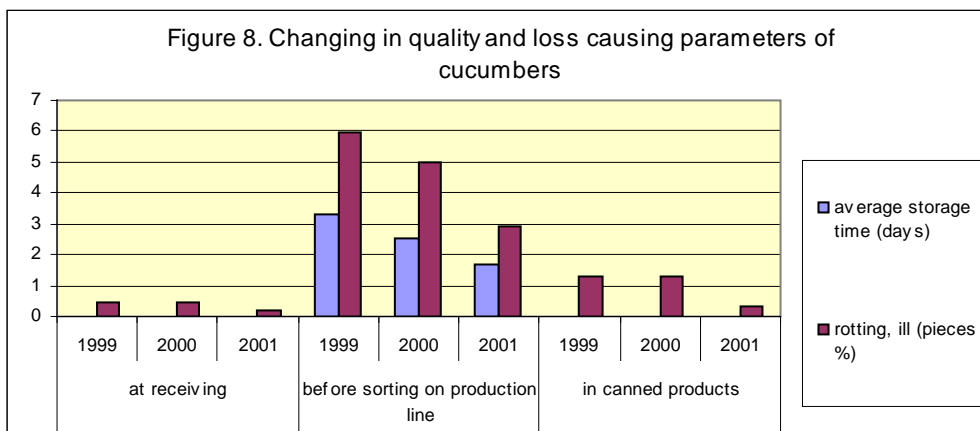
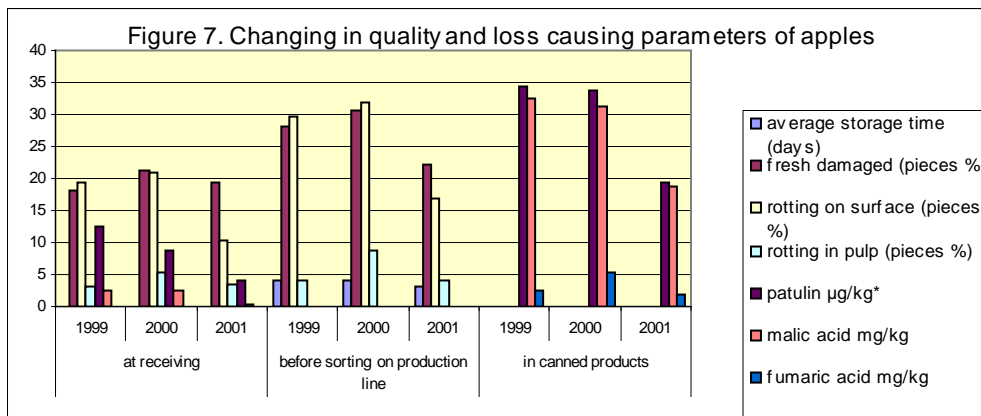
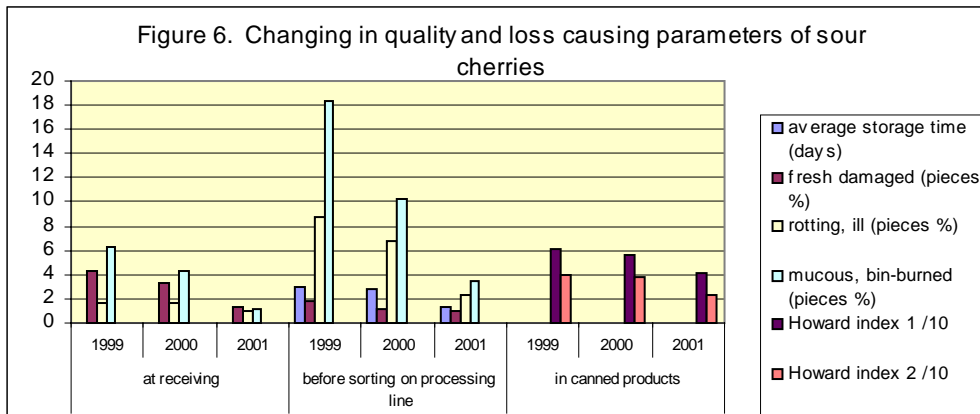
**“B” process:** d/ **We prepared the catalogue of all methods of packaging** applied by the Company, indicating the selected and proposed combinations therein.

e/ We established **the job title in charge of the packaging and arrangement** to comply with the customers’ expectations, while maximally taking into consideration the cost-saving, but at the same time profit increasing aspects of the canning factory.

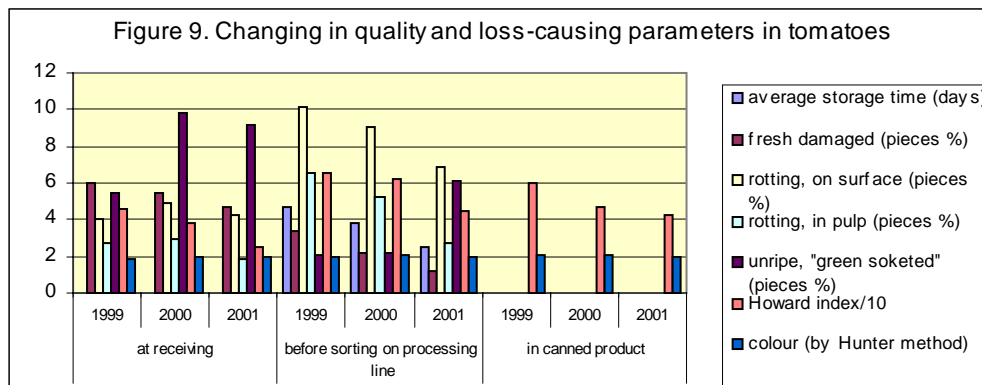
f/ The efficiency and effectiveness of the involved processes were checked in 2000 and 2001 with the monitoring examination of the losses.

***Parameters of raw materials and finished products, and measuring the output losses***

The results of the annual raw material measurements, the changes in the loss producing and quality parameters between 1999 and 2001 are shown in **Figures 6-9**.



<sup>10</sup> The process improvement model set forth by Tenner-deTorro does not mention that the testing of the suggestions can be facilitated by taking supporting measures.



The results were subjected to a **statistical examination**. The results are as follows:

- **Considering the apple**, there is a 99 % probability that the proportion of damaged raw materials measured when sent onto the line had decreased significantly, that is it was the result of the introduced measures.

As for the patulin measured in the apple at the time of arrival, there is a 95 % possibility, while as for the lactic acid measured at time of arrival, there is a 90 % possibility that the decrease was caused by the introduced measures.

- **Considering the sour cherries**, there is a 99 % probability that the freshly damaged and rotten amount at the time of arrival, and the rotten amount measured at the time of sending onto the line had considerably decreased during the years under control, and there is a 95 % probability that the storing period before processing had been reduced thanks to the measures.

- **Considering the tomatoes**, there is a 99 % probability that the differences of the parameters measured year by year were noteworthy, that is the storing period before processing, the freshly damaged amount, the indexes measured at the time of arrival, sending the raw materials onto the line and the finished product Howard index had significantly decreased, that is the changes were due to the introduced actions.

- **Considering the cucumbers**, although the storing period before processing and the measured parameters had decreased noteworthy, it could not be proven that the favourable changes resulted from the introduced measures, that is they were significant.

⇒ Thanks to the introduced measures, considering the four raw materials under control, and reducing the number of packaging methods, etc. we effected a serious saving. The extent of the saving is shown in *Tables 4 and 5*.

Table 4: Savings realized in raw material handling in 2000–2001 vs. 1999 (in 1000 HUF)

	Year	Raw material	Savings	Year	Raw material	Savings
Recognized raw material loss in 1999:  <b>139.507.700</b>	2000	Tomatos	7.059	2001	Tomatoes	9.724
		Apples	0		Apples	39.204
		Cherries	5.106		Cherries	16.406
		Cucumbers	2.418		Cucumbers	4.222
	<b>Total</b>		<b>14.583</b> (10, 5 %)	<b>Total</b>		<b>69.556</b> (49,9 %)

Table 5. : Savings realized through packaging materials variation reduction in 2000–2001 vs.1999 (in1000 HUF)

	Year	Packaging variations reduction	Savings	Year	Packaging variations reduction	Savings
Recognized packaging loss in 1999  <b>30.798(100%)</b>	2000		<b>2.276</b> (7,4 %)	2001		<b>4.842</b> (15,7 %)

Although **the extent of the savings as %** is relatively low, **it is particularly valuable** to us, taking into consideration the earlier average profitability level of the canning industry(3.3 %).

**Step 6: Standardisation of the processes:**

We integrated the solutions of proved value into our daily work. The prescription and the daily rutin of “A” and “B” processes were modified with the successful solutions.

**Step 7: Maintain the results and find other loss reducing possibilities,** with the help of which we could further decrease the losses of the raw materials examined till now, and extend the elaborated method to the other raw materials of less decisive volume, etc.

**4.3.3.2/ Increasing quality evenness of canned food by the method of process improvement**

**Step 1: Identifying the problem:** the quality of our products is not even, it is variable.

**Step 2: Identifying the involved processes:** The process of comprehensive quality assurance.

**Step 3: Measuring the performance of the process**

We measured the performance of the process at the level of the final result, that is the level of customers' satisfaction. The results from 1998 are illustrated with the results from 1999, 2001 and 2002 in *Table 6*.

Table 6.: Survey about the satisfaction of our costumers (extract)

Serial number	Question	Possibilities for the answer	The proportion of the answers			
			1998	1999	2001	2002
<b>• About the products:</b>						
7.	How do you find the quality of our products?	excellent	49	21	44	52
		good, even	0	17	27	29
		good, but not even	37	42	26	17
		not suitable	12	14	1	1
		not answered	2	6	2	1
8.	How satisfied are you with the packaging and transporting of our products?	satisfied	58	57	72	73
		not satisfied	42	38	25	26
		not answered	0	5	3	1

**Step 4: Developing solution suggestions**

Our solution suggestions focused on the concept that **all the actions** related to the manufacturing of a product **should be considered as one process** in the value creating process, and guidelines should be drafted. We should prepare the QACCP analysis for each action of the processes (see Figure 4) and elaborate the **QACCP system** of the process (action, quality hazards regulating method, risk assessment of hazards, critical points, critical limit values, supervisory, corrective and justifying methods, etc.). The main aspect of developing this system was that the **preventive character and process-attitude** should play a great part.

**Step 5: Accepting and testing the suggestions**

We introduced and tested the elaborated **QACCP system** as the system of preventive measures. We checked the quality evenness of the products with a new customer's survey and by studying the complaints. (See Table 6.)

**Result:** According to the opinion of our customers, in 2002 the quality evenness of our products improved, only 17 % of our costumers believed that it remained variable. At the same time, the proportion of customers finding the products of excellent, or good and even quality had remarkably increased. Our efforts to make quality even had actually achieved our purpose by 2001, but rather by 2002, when our customers could really appreciate this.

**Step 6: Standardisation of the processes:**

We integrated the solutions of proved value into our daily work.

Standardised process: the process of the comprehensive quality assurance of the products.

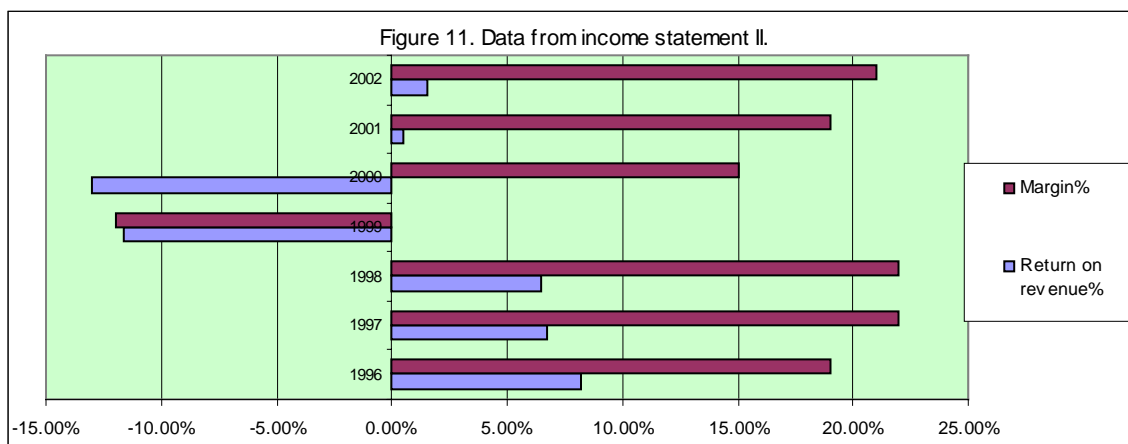
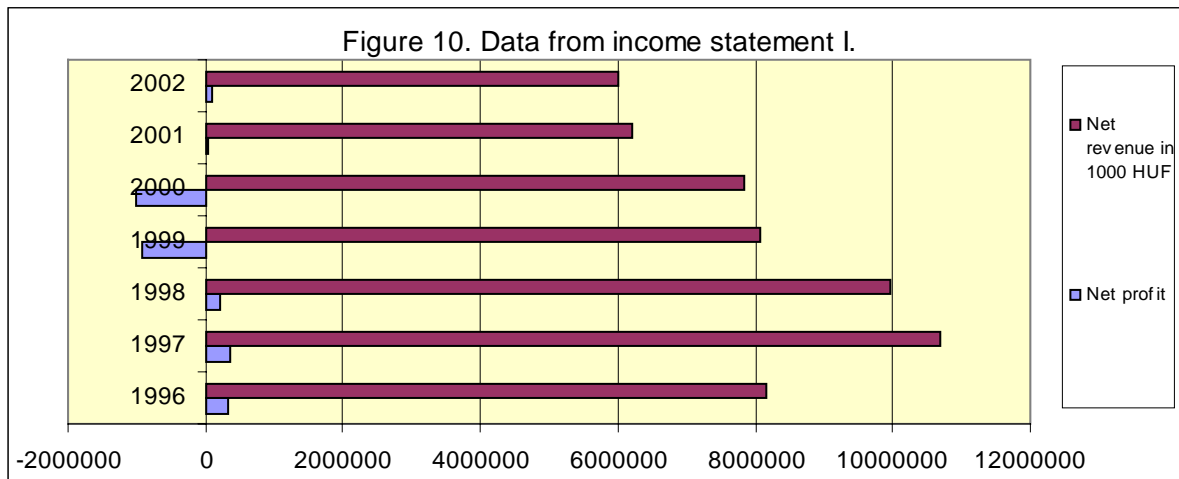
**Step 7: Maintain the results and looking for new improvement possibilities**

**4.3.4/ Improvement of key results**

Thanks to our efforts, we could produce results in this field, too. (See **Table 7., Figures 10-11. and Figure 3.**)

Table 7. :Data from income statement

Data	1996	1997	1998	1999	2000	2001	2002
Aftertax income	339.387	356.817	202.698	- 933.335	-1.023.224	31.653	93.000
Net revenue in 1000 HUF	8.165.465	10.696.284	9.975.550	8.061.172	7.845.082	6.207.827	6.000.000
Return on Sales	8,20 %	6,77 %	6,49 %	- 11,6 %	- 13 %	0,51 %	1,5 %
Margin	0,19	0,22	0,22	- 0,12	0,15	0,19	0,21



Summarized it can be laid down as a fact that the profitability of our company is still lagging behind the profitability of leading canning companies (which was 3,3 % in 2002). Therefore our efforts to improving the key results – inspite of the positive trend – should be increased during the second phase of TQM introduction.

## **5/ INTRODUCTION NEW AND NOVEL RESULTS**

1/ Unlike earlier researchers, who only examined quality deterioration during storing, or the relations between the quality of the raw materials and the finished products, I **studied the following important correlation** of four factors regarding the important raw materials of the canning industry: quality of the raw material - complex quality of the finished product – production cost of the finished product, and **I found a close correlation among them.**

2/ At the canning factory under inspection, I established that **the highest loss expenses can be detected at the input and output points.** This can be explained by the fact that it is easier to regulate and smoothly operate a process starting and ending within the company than a process that starts or ends outside the company. In the latter case, it is more difficult to prepare regulations that can clearly be kept and operate the process keeping well under control.

3/ Since its raw materials are natural materials with parameters depending upon the year, the land of cultivation, etc., it is difficult to guarantee the evenness of the quality of canned products. For this reason, **a comprehensive quality management system covering all the activities should be introduced,** and, besides the HACCP system, it is expedient to **introduce the QACCP system** which is a system preventing the quality from variations.

4/ **I was the first to collect and compare the available TQM introduction procedures,** collecting similar and the unique steps, which helped me in elaborating a special **TQM introduction model applicable to a canning factory struggling with financial/operational problems.**

5/ In order to introduce TQM, **I developed a special model that can be applied to canning industrial enterprises showing deficit or inconsiderable profit, struggling with operational problems.**

The model implements the introduction of TQM in two separate phases.

6/ **I connected the new introduction model of TQM with the application of the EFQM model as an enterprise diagnostic means.** Consequently, phase I of the TQM introduction commences with the preparation of a diagnosis performed with the EFQM model. I developed a new scoring system of the EFQM model, which can better be applied in the Hungarian conditions and to the canning factories struggling with operational problems.

7./ **I transformed the model of process improvement described by Tenner-de Toro.** This way the model can be applied to improve the logistic process of raw materials far more effectively. The transformation is as follows:

- Step 3 of the general process improving procedure is the measuring of the performance. However, according to the transformed procedure, **only the process losses are measured** instead.

- In the description of the above model, the authors do not determine how to test the elaborated suggestions. The solution recommended by me, **i.e. taking measures ensuring the operation of the process**, largely contributes to the effective testing of the suggestions and the selection among them.

**The method of process improvement can be made even more successful** if, together with the identification of the processes (in Step 2), **we identify the success criteria thereof, too.**

## **6/ RESULTS TO PUT IN PRACTICE**

1./ **Raw material supply-logistics justified raw material inspections – raw material quality - complex quality of the canned products - direct canned food production costs – profit correlations** are to be looked at when competitiveness of the food processing enterprises is to be increased.

2./ Loss reduction project in the food processing industry is to be started by ensuring raw material quality, ie. minimizing loss as well as the reduction of packaging methods variations.

3./ Variation in processed raw material quality – due to variation in raw material parameters – is to be reduced by a complex quality management system, QACCP, implementation which is to span across of areas of activities.

4./ The 2-step TQM implementation model – which is to increase shareholder return by first and foremost reducing significant losses – is an excellent tool to make companies that struggle with operational problems, successful.

5./ The EFQM model with modified point-system helps to pay attention for the most important factors - such as: management and key results - in successful operation of the company. That is why it can be applied much better for self assessment of companies fighting with operational problems than point-system used for companies with excellent operation.

6./ The modified process improvement version is suitable for ensuring significant improvement in raw material supply-logistics and thereby extensively improving raw material quality and for reducing raw material related and other losses.

## **7./ BOOKS, PUBLICATIONS, LECTURES ON THIS THEME**

- 1./ **The role of quality and the status of quality affairs in the canning industry.** (2002.) Presentations of Session of MTA Szabolcs-Szatmár-Bereg County Scientific Committee. Nyiregyhaza. p. 48-54.
- 2./ **Quality Management. Open University Program for Agricultural Entrepreneurs. Text book.** (2002.) Nyiregyhaza, ISBN: 963 9385 43 3. p. 70
- 3./ **Quality Management. Open University Program for Agricultural Entrepreneurs. Text book for Open University courses.** (2002.) Nyiregyhaza, ISBN: 963 9385 53 0. p. 90
- 4./ **Quality Management. Open University Program for Agricultural Entrepreneurs. Work book for Open University courses.** (2002.) Nyiregyhaza, ISBN:963 9385 44 1. p. 41
- 5./ **Quality Assurance systems for agricultural and food industrial products: HACCP, GAP, GMP, GHP, Requirements in EU for food items. Certifying of quality.** (2003). In: Quality assurance knowledge for agricultural and food industrial small and medium sized entrepreneurs. Edited by: Dr. Nadasdi József. Nyiregyházi Főiskola Képzési és Továbbképzési Intézet. Nyiregyháza, PHARE HU 0008-02-01-0017. p. 46-131.
- 6./ **Corporate diagnostic self assessment using the European Excellence Model.** Annual Book of Vasile Goldis University. (2002) Oradea – Satu Mare, (accepted for publication).
- 7./ **Quality Assurance in food processing enterprises.** Annual Book of Vasile Goldis University. (2002) Oradea – Satu Mare, (accepted for publication).
- 8./ **Quality Management in Agriculture.** Annual Book of University Demjantschuk Rivnye, (2002). (accepted for publication). Presentation on International Scientific Conference, University Demjantschuk, Mai 16. 2002.
- 9./ **Changing function of quality and quality assurance in the Hungarian food industry.** Inventarium. Nyiregyhaza College. 2003. (accepted for publication).
- 10./ **Improvement of competitiveness of enterprises by TQM.** Presentation on Conferences organised by Sz-Sz-B. Megyei Kereskedelmi és Iparkamara, January 29. 2003. (accepted for publication in Inventarium Nyiregyhaza College, 2004).
- 11./ **Quality assurance in canning industry.** Presentation on Scientific Conference organised by DEATC September 12. 2002. In: Redacted by Nagy J. (2002): EU-conform agriculture and food safety. DEATC-KITE RT.-MTA-DE Földművelési Kutatócsoport. Debrecen. 237-243.o.
- 12./ **Possible contribution of TQM to increasing the competitiveness of canning industry-** Presentation on XXXV. Konzervipari Napok Scientific Conference. Nagykőrös, Mai 13. 2003. (accepted for publication by General Editor of „Konzervújság”)
- 13./ **Loss reduction of canning industrial raw material by process improvement.** (2003): „Magyar Minőség”, No. 10. p. 17-22.
- 14./ **Special features of quality management systems in the canning industry.** (accepted for publication by General Editor of „Minőség és Megbízhatóság”)
- 15./ **Integrations tasks in quality assurance systems of Canning Factories of Limpex plc.** (2000). Presentation on XXXII. Konzervipari Napok Scientific Conference. Nagykőrös, Mai 15. 2000.
- 16./ **Food safety and production costs of canned fruits and vegetables as factors increasing the competitiveness.** (accepted for publication by General Editor of „Magyar Minőség”)

**17./ The role of quality management in enterprises of North-east Hungary, especially in food industrial companies.**  
Presentation on „Let's learn from each other” Conference of League of TQM. Budapest, December 09. 2003.

**18./ Quality management.** In: Edited by I. Egri: Entrepreneurs' knowledge. „Development of the Entrepreneurship in the middle and higher education. In frame of PHARE-HU 0105-03 VÁGI. Tender. (accepted for publication by College of Nyiregyhaza) p. 24.

**19./ Nadasdi J-ne– Tóth A-ne (1985): Changing in quality of cucumber raw material during storage .** Konzerv – és Paprikaipar. Vol. 4., p. 140-142.

**20./ Nadasdi J-ne et al. (1987): Technology and quality of apple processing at „Nyírség” Konzervipari Vállalat.**  
Konzerv- és Paprikaipar, Vol. 4., p. 155-160.