

The Effects of Total Quality Management Practices on Performance within a Company for Frozen Food in the Republic of Macedonia

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Abstract – The subject of this paper is designing and implementation of the TQM philosophy within a frozen food company which deals with processing, manufacturing, distribution and sale of products from snails which is exclusively for export. Analysing the business processes within the company for snail processing using the TQM methodology it was proven that the performance has been significantly improved. The results of this research have shown that the TQM implementation at this company has not only contributed to the quality improvement of the snail processing products but also to the increase of productivity and optimization of the quality costs. In future the implementation of this methodology in this company will provide contentment not only to the consumers but also to the suppliers, employers and the community.

Keywords – Quality improvement, flowchart, Total Quality Management (TQM), QC - CE Pyramid model, internal standardization.

1. Introduction

Total quality management (TQM) is a structural system designed to meet the internal and external needs of consumers/ users and suppliers by integrating them within the company and improving

the business climate, the opportunity for innovation and development, and business processes and culture [1]. In practice, many organizations recognize that the philosophy of TQM is to constantly improve the performance of products / services. The commitment of the management, focusing on customers, the involvement of all employees in the processes, continuous improvement as well as partnership with suppliers and measuring performance are the basic concepts that underpin the philosophy of TQM, and it is imperative for the survival of the companies in the 21st century [2]. The subject of this paper is the design and implementation of the philosophy of total quality management (TQM) in a frozen food company that performs processing, manufacturing, distribution and sale of products from snails, exclusively for export. In this company the production is mainly concentrated on the processing of snails by processing the living snail meat and cleaning snail houses; preparation of the products – Renco, Renco and butter with frozen meat and clean houses; and preparation of canned snail meat from frozen snail. In order for the company to be able to produce a safe and quality product the introduction of internal standardization is mandatory, because that is the only strategy that could maintain the constant consumers as well as the potential ones by responding to their demands.

The standards could eliminate barriers in trade, support the development, promote innovation, ensure product quality, increase safety and protection, and improve the validity and the reputation of the company. By analyzing the company's business processes and their optimization the consistent exceeding of the growing expectations of consumers of products is achieved.


The company specifically analyzed the activities in several departments (production lines) where defects and omissions are being detected daily. The application of the integrated methodology for design and implementation of TQM system in this company refers to the application of several methodologies:

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Methodology of the subsystem - internal standardization; Methodology of the subsystem - statistical process control (SPC); Methodology for analyzing the total cost of a given process; Methodology of the subsystem - education; Methodology for evaluating the success of the designed and implemented system in TQM (Audit) [3].

Nowadays, the success of the business processes cannot be seen as successful without the use of computer systems [4]. Those computer systems according to its hardware and software content represent the basis for rapid transmission of information for the implementation of business processes that are always associated with the response towards the questions, who, how, where, when, and the linkage to the questions: who – responds to whom for the work being done at the company etc. This is the passage through which the data is gathered for the standardization development of defect-free production, cost analysis, as well as the fundamental pillars of the system with total quality management (TQM) [5][6][7][8][9].

2. The necessity for designing a quality system in the company for snails processing

The subject of this paper is the design and implementation of the philosophy of total quality management (TQM) in a frozen food company that performs processing, manufacturing, distribution and sale of products from snails, exclusively for export. The company is mainly focused on snails processing into finished products by processing the live snail meat and clean houses; as well as preparation of products Renco and Renco with butter from frozen meat and clean houses; and preparation of canned snail meat from frozen snails. In order to build an effective subsystem for internal standardization, the top management must create a business climate of cooperation and communication, because every idea besides having the potential for improvement or innovation is also generating new ideas.

The plan for design and implementation of the subsystem should be the simplest way to distribute tasks in a timely fashion and in a specific order with the intention to be able to work successfully and on time, and most frequently used tool for such task is the gantogram.

The design of the subsystem - internal standardization as part of the TQM system is a teamwork and in places where the rules of teamwork are not highly respected it could be assessed as unacceptable [10]. At the same time, the following methodology must be allowed not to block the

decision-making due to excessive individualism, exaggerated expectations, lack of flexibility and the creation of consensus-building attitudes. Contemporary interpretation of the importance of the company system in TQM and staff lies in coordination between the system and the people.

The methodology in the design and implementation of internal standardization [11] is given in Fig.1.

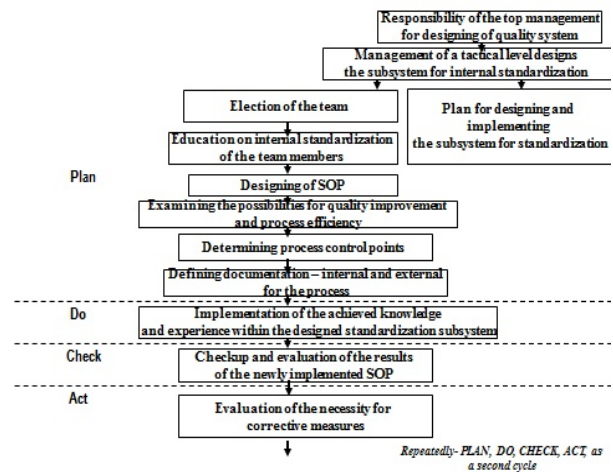


Figure 1. Methodology of process design and implementation of the subsystem of internal standardization in a company

Through the standard operating procedures (SOP) the flow of business processes is defined and on that basis the obligations and responsibilities of all employees are defined as well. During the course of action, it has to be taken care to keep the processes simple and efficient (more matters combined into one). The process should be performed in a natural and shortest route, aimed at results and not at tasks, and by specialization of the person performing the task. The number and scope of these procedures (SOP) depends on the number of activities in a given process. Regardless of the number of SOP, they should be connected, meaning that the output of one process needs to become an input to another. The procedures help achieving order and discipline in the operation, because it leads to proper communication between employees regarding solving problems related to quality. The best way to graphically display SOP is through block diagram, which consists marked phases of the business process flow, employees that perform activities as well as incoming and outgoing documents. In this manner any shortcomings are immediately perceived and quick reaction in removing the causes of them could be applied immediately. The block diagram is the simplest and most practical mode to describe the business process [12].

The company for snails processing deals exclusively for export, and the business processes are implemented through 120 experienced employee's involvement of seasonal workers who attend additional training in order to avoid any delays or irregularities. The company provides two final products: Renco with butter, and canned meat and semi-finished Renco (pure snail meat). Types of snails that are processed are: *Helix Pomatia* and *Helix Lucorum*.

The company owns the following product lines:

- line for cooking and bleaching of live snails;
- line for washing, drying and calibrating the houses of snails;
- line for thermal processing of snail meat.

Figure 2. presents the organizational structure of the company. The management attempt to improve the quality of products, imposed new focus on the activities aimed at responding to the desires and the demands of the products' consumers.

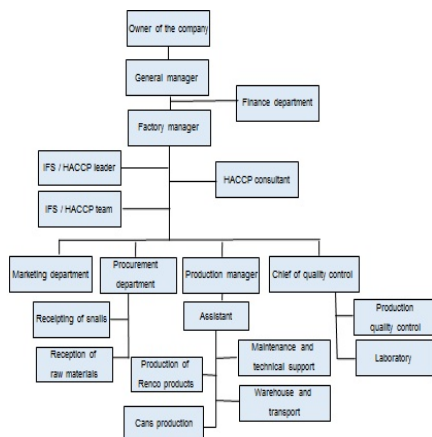


Figure 2. Organizational structure of the company for processing snails

The philosophy of TQM is confirmed as a good practice around the world, and its implementation in the company refers to the fact that the company's management with their good will and perseverance is including their own human resources by forming teams of all profiles, integrating their knowledge in terms of cost reduction and achieving the required level of quality products, and proactive internal and external communication in order to achieve the demands of its customers [10][13].

3. Implemented model system of quality in the business process of snail treatment and preparation

The business process of treating the snail preparation as part of a cooking line and bleaching of live snails is performed according to the standards. The living snail is accepted solely in plastic crates with a lid or gauze bags. Randomly an input reception of raw materials is being done through the sample in a manner that stands out for 10% of the accepted amount. Out of that selected amount, the employee assigned for quality control determines the percentage of dead snails. The measured quantities are placed in pallets that indicate the amount, date of admission, gross and net weight of the pallet, the type of snail and the name of the supplier. If raw materials are not immediately involved in the manufacturing process, they must be stored in a cooling chamber at a temperature of 40°C. Before the beginning of the snail slaying process, 10% saline solution is prepared in which the living snail is placed, continued in a bath of water at a temperature higher than 90°C. Slaying (snail cooking) should not be done for more than 6 minutes. The next step is the process of calibrating thermally processed snail and separation into fractions according to the size of its houses. The calibrated snail is delivered into the cutting premises or process, where the separation of meat from the snail house is being performed. Starting from this basis [3], we analyzed the established system of quality within the business process of treatment and cooking of snail meat, and with corrections and additions, by using the QC-CE-Pyramid model, its performance and efficiency has been improved.

Figure 3. provides a standard operating procedure of the business process of treatment and preparation of snail, which contains the documents used in the process, employees who participate, and comments with additional explanations of instructions which define the sub-process. The standard operating procedure starts with planned activities and inputs; it continues with the activities of the business process and each stage receives the output information which is an input for the next phase; finally, the business process concludes with information - the result, Fig 2. Through the QC-CE model for quality the obligations and responsibilities of all employees are defined. Thus rules of conduct in order to achieve good interpersonal relations are created.

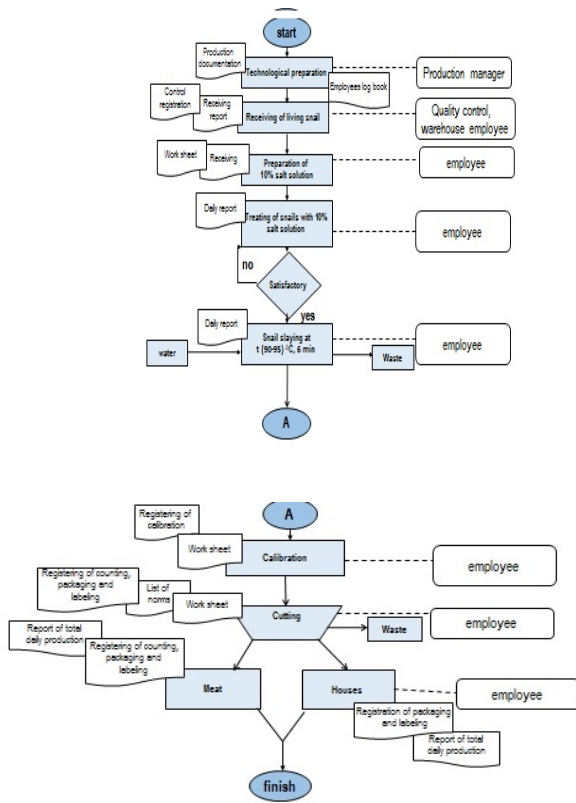


Figure 3. Diagram of development of the business process of cooking and cutting snail (from delivery of the raw product/snail through cutting of cooked snail)

Through QC-CE- Pyramid model all business processes in the company can be standardized through standard operating procedures in the form of control cards. Moreover, a vertical and horizontal connectivity between employees, according to the structure of the pyramid is accomplished [4]. Thus, quality assurance in the company is followed by the information flow in accordance with the standard operating procedures. The circle closes with responses to the questions: what, who, where, when, who gives information to whom with complete supporting documentation in which quality commitments and responsibilities are specified. In order to have an effective quality system, besides being defined, it needs to be well documented.

The methodology of TQM (Total Quality Management) was also applied to other business processes that lead to improved quality through their questioning, defining, enhancing and designing, improving productivity and optimizing the cost of quality. The model that was applied is the integration of information technology with internal standardization of business processes [4].

4. Implemented quality system model for the business process in preparation of snail meat

The business process starts with cooking the snail meat, previously cleared of hepatopancreas which continues to the process of packing and freezing. The meat is brought for cooking in an open system (separate dishes - duplicators). After reaching the required temperature of boiling the process of cooking starts which lasts about 6 minutes. The cooked snail meat is rinsed with cold water to cool down and remove the slime. The cooled and rinsed meat is sorted and packed in plastic bags of 5 kg, placed in plastic crates and frozen in a chamber at a temperature of -18°C and packed again in cartons of 20kg. Each box is labelled in order to ensure traceability of the batch. When the meat is finally packed it is placed on pallets and stored in a chamber for frozen meat at a temperature of -18°C (the temperature is controlled by the office of quality control and technical service). The following is the diagram with description of the activities of the business process for the preparation of snail meat, Fig. 4.

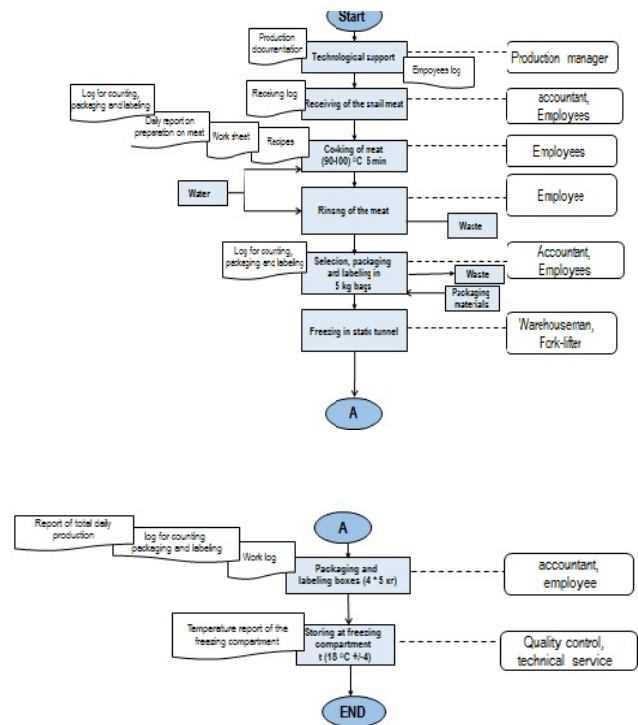


Figure 4. Diagram of movement of business during the process of preparing the snail meat

This improved system enables an efficient management process.

5. Implemented quality system model for business processes for preparation of snail houses

Business process for the preparation of small snail houses begins when empty and dirty houses separated in the cutting process are being labelled in plastic bags. The plastic bags stored at atmospheric conditions in order to execute fermenting waste which is located in small snail houses successfully. After the completion of fermentation, the houses are transferred to the washing line. Washing is done in tubs of hot water with a temperature not below 80°C. After washing the houses are dried in a dryer with hot air at a temperature of 50-80°C in order to be clean and dry. The clean houses are calibrated in calibrator according to the dimension of the shell - house. The cleaned houses are collected in plastic bags and placed in cardboard boxes and lined for label with all the required data by the standard of the company. The finished pallets with clean houses are stored in the warehouse for empty houses to be re-used in the next stage of preparation for finished product, Fig. 5.

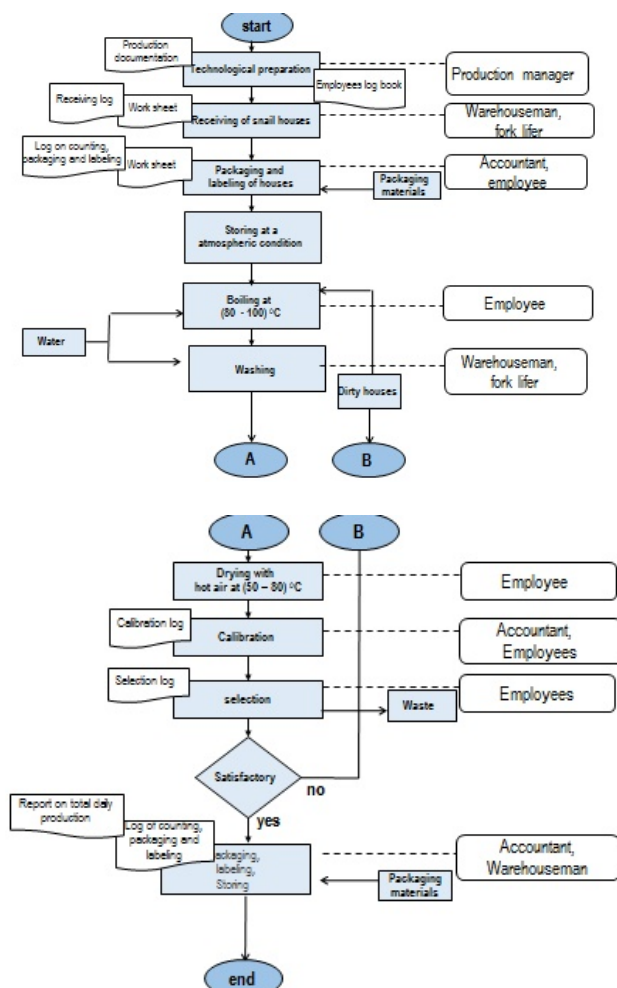
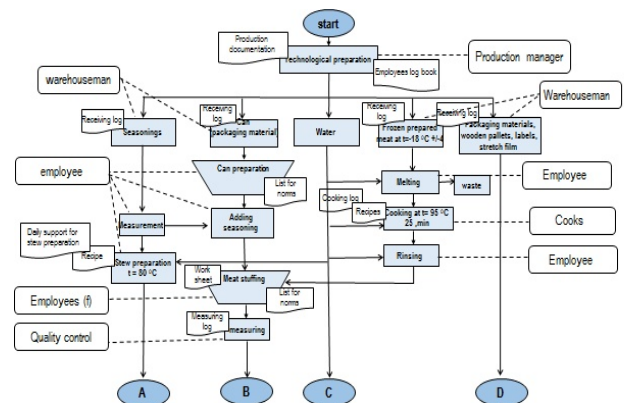


Figure 5. Diagram of the progress of the business process of preparation of small snail houses

6. Implemented model of the quality system in the business process for the preparation of Renco and Renco with butter

Business process of preparation of Renco and Renco butter begins when frozen snail meat is removed from the chamber for frozen meat, submerged and cooked in a closed system at a temperature of 120°C, at a time that is set depending on the size of the snail. During the cooking of the snail meat spices are added. The cooked meat with spices is then cooled in cooling system "Ben Mari", and further brought into the room to prepare the finished product - Renco or return the prepared meat to the snail houses. Previously washed and dried houses are brought to the working tables and merged with the cooked meat. This is how the product – Renco is manufactured.

The product is frozen in a tunnel at a temperature of -18°C. If the customer has ordered the snail meat as Renco, the product is packed inside the premises in polyethylene bags and cardboard boxes that are labelled with the data required by the standard in the food industry. Renco packed boxes are stacked on pallets, wrapped in foil and stored in a chamber for the finished product, when the preparation for transport follows. If the customer's order refers to the finished product - Renco with butter, then the product is mixed with butter and spices. The mixture is prepared according the recipes that are prepared depending on the customer's requirements. The butter is prepared in special machines for mixing spices (cutter machine). The prepared butter with spices is delivered to the premises for the final product where employees apply it to the previously prepared product - Renco. Product – Renco with butter is brought again to the freezing chamber at a temperature of -18°C, and after freezing the procedure of packaging and labelling as the previous product Renco follows, Fig. 6.



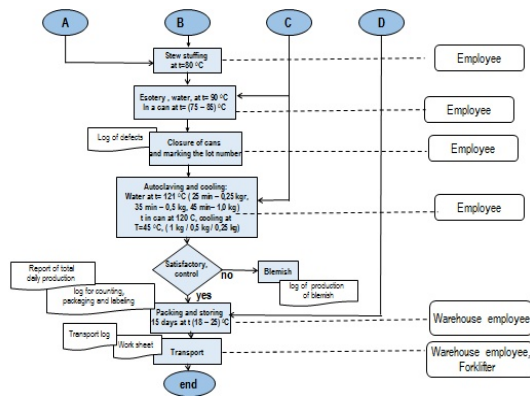


Figure 6. Diagram of the progress of the business process of products preparation of Renco and Renco with butter

Through the control card the whole running process and the critical points in the process can be seen to avoid bottlenecks, to monitor the movement of materials and employees or define the obligations and responsibilities of each participant in the process could easily be identified.

7. Implemented model of the quality system in the business process for the preparation of canned snail

The business process of preparing canned snail starts with dipping of previously purified and cooked meat in tubs where it's boiled in an open system up to boiling point, with a duration of turmoil that is set depending on the fraction (size) of meat from the snail for not less than 25 minutes. The cooked meat is cooled by flowing water and brought to conveyor belts where cans are filled, while the empty cans are transported from the stack cans, located next to the plant. In the stack, each tin and lid are sorted by size and have their designated place. When the cans arrive to the plant, they are rinsed and filled, first with spices, then manually with a predetermined number of pieces with different sizes of meat according to the defined specification. The meat can be supplemented with previously prepared hot spicy soup that through pumps and filters is transferred to the cans.

Then-filled cans of soup and meat are proceeded to an egzoster (pasterizator) at a temperature between 75oC - 85oC in order to expel the residual air between the soup and meat, or to avoid aeration. Then the prepared cans are transported to the automatic machine for final packaging/closing. Immediately upon closing, there is a machine that marks the characteristics of the product, and the date of production and the validity. Closed and labelled cans are placed in iron buckets and carried towards autoclaving. Then the sterilizing procedure is done at a temperature of 121°C in order to ensure fully safe and reliable product that meets the customer's requirements within the specified duration. The cooled cans are labelled and stacked on pallets and then prepared for transport to the buyer. The finished product - the can could appear in a weight of 1 kg, ½ kg and ¼ kg. At the end of the production process each employee cleans his workspace. All steps of this business process are controlled by the responsible people i.e. quality control, in order to meet the product specification, organoleptic properties (taste, smell), and the quality and stability of the product required by the existing regulations, etc. Fig. 7.

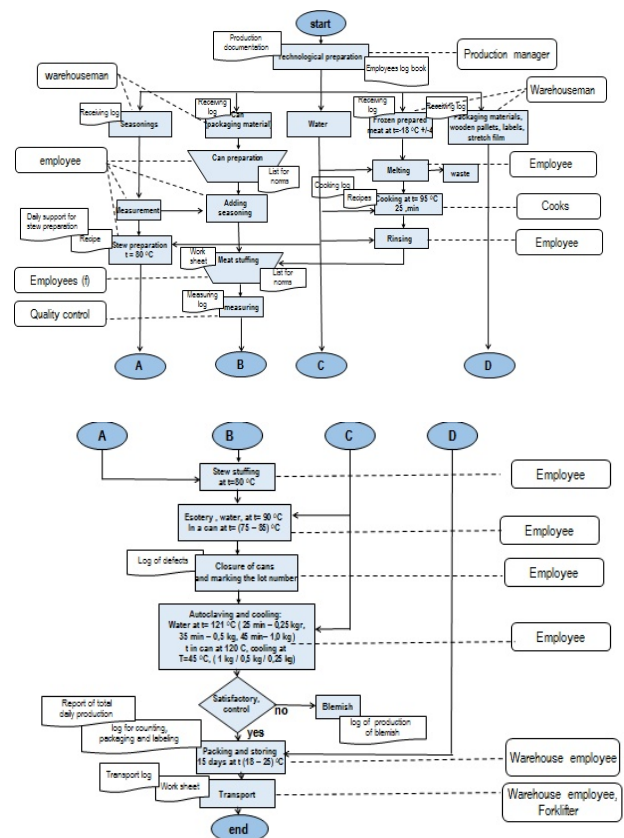


Figure 7. Diagram of the flow of the business process for the preparation of canned snail

7.1. Critical control points for canned snail

In the process of canning snail meat two critical control points occur, the closure of the can and autoclaving.

Control of the process of closing the finished product – canned product, is conducted in a way that the person responsible for quality control of the service makes compulsory control by closing the finished product in a can. Using a micrometer the thickness and height of the fold ring of the cap is measured, the external closure is removed and with a micrometer the inner fold of the can and the lid is measured. The obtained data is recorded and filed.

The control temperature for autoclaving with a maximum registering thermometer is done in a way that the person responsible for quality control controls the process of autoclaving, meaning the temperature by using thermometers registering maximum, but also the time of autoclaving is measured as well. After each autoclaving the temperature is noted which is registered on the maximum thermometer, the time of autoclaving and all data recorded in the records / reports. The temperature and time are automatically recorded through measuring instrument (thermograph) that records these parameters available in electronic and paper form at all times.

Despite the customary set business processes, this company faces faults on a daily basis, according to which the corrective measures are being undertaken which require the involvement of all employees in discovering the causes, especially paying more attention in taking preventive measures. It is therefore necessary to apply the appropriate methodology for the methods and techniques for flawless production and methodology for optimizing costs [6]. This methodology offers especially a support of the top management, acquired due to presented results of the implementation of the methods and techniques in this company, and the involvement and commitment of every employee, because the ones involved in these processes are the ones that improve them [14].

The combination of QC-CE pyramid model provides the company with a choice of decisions that define the responsibilities of each employee in this company and enhance collaborations among employees revealing their rules of conduct [3]. The analysis of internal standardization and application of QC-CE pyramid model was completed with a proposed corrective measures and defining of the responsibilities of each employee in the business process by creating internal coordination and cooperation.

8. Conclusion

The analyses of practice showed that the application of the methodology for total quality management in the company for processing snails lead to increased effectiveness and efficiency [15][16][17]. Thus the traditional model of the development of business processes in which the errors, omissions, and claims are measured, has been replaced by preventive, proactive work.

Without the commitment of top management towards the set goals for quality and consistency in their implementation, all these efforts would only present a waste of time and money and at the same time will reduce the scope for success in any other further initiative. The integrated methodology for the design and implementation of TQM system has feedback resulting from the necessity of permanent improvement of business processes. By repetition or spiral repeating of these cycles the benefits of the application would be seen, according to which the organizational culture to such initiatives is to be changed which could be represented as an incentive to higher goals of excellence.

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