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Changes in Lifestyle of Population and Solutions in Logistics of Bakery Products: Practice in the Czech Republic

Radka Vaníčková
Faculty of Corporate Strategy
The Institute of Technology and Business in České Budějovice, České Budějovice, Czech Republic
vanickova@mail.vstecb.cz

***Abstract*—The aim of this contribution was to highlight the possibilities of increasing volume of production by optimizing logistics and production processes in order to increase the demand for three types of bakery products. For collecting and analysing data was used method of observation, for optimization of logistics and for production process is used method of network analysis (CPM, PERT). Critical Path Method has been applied to individual production processes that have impact on demand for products and services. In order to volume increase of production of bakery products and the efficiency of logistics and production process have been suggested recommendations and new value-added measures, effectiveness of which has been economically evaluated by the ROI method, including return on investment. Due to the flexible forms of jobs and changes in the lifestyle of the population, demand for bakery products of fast food is increasing. It is also changing style of shopping, receding from traditional, large, weekly purchases to partial, daily, smaller purchases. Optimizing production process of fine bakery products, fine fried bakery products and consumer bread was solving by purchasing new production technologies to shorten production process, reduce production costs, and support production growth.**

Keywords—changes and solutions, technology of bakery products, critical path, MS Project, optimizing of logistics and production processes

I. INTRODUCTION

Logistics is a sector with great progress that blends into consumer behaviour of customers [1]. Logistics has long been recognized as a potential source of competitive advantage for firms [2]. Leveraging existing or developing new logistics capabilities is one way for firms to create value for customers and themselves [3]. To the logistics process are perceive activities that can be realized for a consideration, i.e. to import, deliver carry send to the place of destination [4]. Logistics and supply chain management, the process of managing material and information flows from the source, through the firm and to the customer, has been recognized as an important part of organizational strategy [5], [6]. Logistics and supply chain management plays an important role in the ability of the firms to remain competitive in the marketplace [7]. Given that demand for products and services is on the rise, it is essential to make more efficient production and production processes that blend together [8], i.e. to introduce new technologies [9] to innovate products [10], to restructure the company [11], to control individual production segments, to observe the principles, regulatory procedures and measures [12], to optimize products and services of the production process [13] and to carry out other, extensive activities and procedures related to marketing functions, sales functions, financial operations through the flow of information and communication technologies, which are the communicating language in the process of short, medium and long term planning and implementation of partial operations related to material flow in the strategic, tactical and operative level. Through optimization of logistics and production processes is possible adequately decrease input costs, increase production volume for the purpose of higher efficiency, added value and return on investment but also flexibility and adaptability of a corporation as a system flexible responsive to the changing conditions and requirements of both the international and domestic global market. The efficiency of logistics increases with the development of functional, information and communication technologies supporting the improvement of customer service [14], [15]. The level of quality in logistics is influenced by the change in corporate culture and management processes, but also by getting support from top management (top - down), by introducing a common vision across the corporation and by implementation of new approaches to accountability in the process of quality improvement [16].

The logistics performance goals meet the customer's needs, realize the movement of flow of material, information and energy as the primary aim of logistics, e.g. by moving the required quantity of material at a specified quality, defined time and place of localization [17]. The economic goals of logistics are focused on securing the provided services with reasonable costs for which the customer is willing to pay in the appropriate quality [18]. The object of the research of production logistics is material flows of raw materials, semi-finished products, products, components, spare parts, preparations, waste [19], [20] including the final product. The production is realized in the environment of production processes consisting of a set of technological and logistic operations [21] whose implementation is necessary for the production of the products in the required quantity, quality, term and price [22], [23]. Logistics and supply chain integration is perceived as an important inter-firm practice

[24], which leads to better performance [25]. Nevertheless, logistics integration still remains a challenge due to the complexity and involvement of multiple organizations.

The food supply chain is regarded as a composite network of many subjects linked from "farm to fork", say [26]. There is not much detailed research on supply chain management in the agribusiness companies [27] which differ in many ways, e.g. terms of seasonality, type of the required transportation vehicles, employed storehouses and storage periods [28]. Perishable supply chain is considered as supply chain for products which undergo change in storage and gradually become partially or entirely inappropriate to consume and needs to be designed to deliver product in a timely manner. Shortened delivery time causes reduction of work in progress and inventory and also improves abilities and flexibility of logistics.

Lot of food producers work on dissimilar marketing strategies which led this industry to introduce many sustainable practices, e.g. recycling and reuse [29], rationalization of routes, use of alternative fuels and energy-saving technologies or replacement of diesel engines with batteries [30], however a large value can be found in relating sustainable logistics to innovation into one concept or framework [32] which can improve less developed conceptualization of logistics innovation [31] and contribute to implement more systematic and covering development of sustainable logistic innovations [32]. All interested parties in supply chain have to become dynamic and competitive for sustainable business operations [33].

However perishable food industries have to provide goods and distribution between producer and retailer in the fastest way to keep their competitive advantages. Improvement of relationships in supply chain of raw materials, processed products and also better circulation of information in the whole production cycle improve organisation of production and distribution and increase satisfaction of customers by offering significantly higher level of services and qualities of delivered products [34]. Order-to-delivery lead-times are very short (while volumes are high), and supply chains have to address unpredictable variations in the quality and quantity of supply [35]–[37]. All this necessitates an increase in complexity and level of advancement of internal logistics systems of food companies [38].

To achieve demanded standards, monitoring and accountability systems have to be pro-active as well as sophistically tracking and tracing [37], [39]. These days, information influences not only company but also its environment and has impact on business operations. This caused information to be kind of company's nervous system connecting their network of all departments, divisions, subsidiaries, affiliates and employees [40]. Nevertheless, it is often claimed that information systems do not sufficiently support agri-food supply chains in these challenges [41]. These systems have to be able to manage and coordinate many cooperation processes. Currently, logistic systems operate on basis of integrated Enterprise Resource Planning (ERP) systems with possibility to use effective related software for strict logistics application, e.g. Supply Chain Management (SCM), Warehouse Management System (WMS), Electronic Data Interchange (EDI) or Customer Relationship Management (CRM) [38]. Nevertheless, a large number of integrated supply chains are also created within Food Supply Chain Network, mainly when high quality and reliable and sustainable products are requested. The Food Supply Chain Network consists of horizontal and vertical cooperation, alliances, forward and backward integration within supply chains, continuous innovations as well as development and implementation of high-quality, enlarged logistics and information system [42]. Authors [42] describe innovative concepts in logistics and Information and Communication Technologies with following essential characteristics: focused on cost effectiveness; interested in combination of Profit, People and Planet; redefining value propositions, processes and roles of actors in Food Supply Chain Networks; changing concepts from functional to process approach; increasing number of guarantees related to food safety and quality; acceleration of processes through rapid fulfilment techniques and parallel processing; increasing co-operation in supply chains as well as maintaining high flexibility in partner selection; etc.

This contribution should point out the possibility of increasing amount of production of selected bakery products by optimizing logistics and manufacturing processes in order to increase the demand for three kinds of bakery products, namely fine baked goods, fine fried baked goods and consumer bread in different grams. To make the logistics and manufacturing process more effective, the method of critical path was used. Optimizations of logistic and manufacturing processes were evaluated using the MS Project program. In order to increase the amount of production and the efficiency of the logistics and manufacturing process, the final part of the contribution proposes new value-added measures, whose effectiveness was economically evaluated using the ROI method and return on investment.

II. Literature Review

A. *Technology of Bakery Products*

Bakery products are a food product made from different types of dough by baking in bakeries. It is produced depending on the type of bakery products, sweet and salty, which is divided into white bakery products, i.e. products made from white flour, most commonly wheat ground from the inside of the cereal grain after the removal of the packing layers. Bakery products from white flour are light to white, soft and light. The dark bakery products are made of flour, to which the bran is added [43]. Some consumers buy products marked with dark or black bread, believing that are rye flour products, which are most often dyed with caramel, roasted rye, barley or chicory. Whole grain bakery products are made from whole grain flour by grinding cereal grain, most commonly rye, wheat including its wrapping and cereal germ [44]. In order to bakery product could be labelled whole grain, the dough must contain at least 80 % of wholemeal flour from the total weight. For more grain bakery products are bakery products to which dough are added products from mill products from other cereal than wheat and rye [45], such as legumes or oil plants, in a total quantity at least 5 % [46].

1) *Technology of Bread Production*

Bread is one of the basic foods whose input raw material is flour, mostly wheat or rye and water. Into the dough is

added edible salt and yeast to speed up the growth raising. Some types of bread contain spices, such as caraway, sesame seeds, and beans. Wheat or rye flour is used to make the dough. Wheat flour contains gluten that produces a fluffy consistency in bread [47]. Aromatics from rye flour lend bread a typical bread aroma, as stated by [48]. Bread is made with the so-called sourdough, which is produced by mixing rye flour and water in a thin dough that ferments by the natural micro flora of rye flour. Rye flour and water for fermentation are added to the yeast. The process is repeated until we have necessary amount of the yeast for knead the bread (part of the yeast is left as the basis for the next bread). Preparation of the yeast is time consuming, but the rye bread yeast gives bread a typical sour taste and bread aroma. Currently, more liquid yeast is used, which is applied directly to the dough. Bread is baked first quickly when the bake process is under way, and then the temperature is gradually decreases [49]. To make the crust, it is advisable to wet the surface of the bread by hand or to use special devices in oven that increase air humidity [50]. In the final stage of freshly baked bread, the cooling process is important when the cooling time is very long [51]. Then it is advisable to manipulate the bread gently to avoid deformation and shrink of the bread crumb.

2) *Technology of Rolls Production*

Raw materials and recipes used for baking rolls vary according to country of origin. Rolls are mainly made from wheat flour, salt, yeast, malt extract, sugar, water or milk and margarine, when is produced fatty dough. According to the used flour, we divide white and wholemeal, wheat, rye and graham rolls. Wheat flour has more protein than rye, so wheat dough is more flexible, stronger and better malleable. However, it has less fermentable sugars than rye, so a small amount of sugar is added to all the dough, not to rye breads and rye and wheat breads. Rye flour has enough, sometimes an excess of enzymes, which degrade fermentable sugars and ensure smooth fermentation. Wheat flour has fewer enzymes, so to flour are various improvement preparations added, as reported [52].

III. Processing of Raw Materials

A. *Dough Preparation*

The processed dough is put into a stainless basket (the volume of the stainless basket is 440 litres, which corresponds to 300 kilogram of dough). The transport of the dough from the stainless basket to the hopper of the dividing machine can be realized by oblique barrier which is controlled manually. In the case of mechanical handling, the automatic control of the hopper of the dividing machine is controlled by a sensor which controls the dough level in the hopper.

1) *Dough Dividing*

By standard are used one or two 6 lines divisions. For this type of equipment, the dividing machines are used outputs of 3000 pcs / hour / row. The weight of dough pieces is typically from 40 to 60 grams.

B. *Before Rising*

The pendant place before rising is composed of 6 lines, can be used also place before rising with 3 or 9 line, where the pitch of dough pieces in the hinges is 120 millimetres (time before rising is 7 - 9 minute). Risen dough pieces are introducing into three-row roll machines with split flaps and transparent hoses.

1) *Shaping*

The risen dough piece is in a roll machine roll out to round thin flat and introduce to process of roll up that runs between felt conveyor and rollers. Three-row roll machines can be canvas or canvas-free. For easy replacement, they are mounted on a special chassis with a maximum output of 9000 units per hour.

2) *Placing*

The rolled-up roll is introduced by a tube conveyor into the flap of the offset machine, which always fill 3 rows of hinges in the rise place.

3) *Rising*

Rising of the rolls takes place continuously in a closed hanging rising place. From rising place are risen rolls on the conveyor cylinder transfer to belt of output conveyor.

4) *Transport to the Oven*

From the output conveyor, the risen rolls are introduced through tubular conveyor under a irrigational brush, or are irrigated manually. Then they travel to the hopper, where they are sprinkled with salt, poppy seed, sesame and are continuously introduced onto the oven belt.

5) *Baking*

Baking is done on a continuous belt oven. By standards, a single-storey or two or more storey oven is used.

IV. Materials and Methods

The aim of the paper was to highlight the possibilities of increasing the volume of production by optimizing logistics and production processes in order to increase the demand for three types of bakery products, i.e. fine baked goods, fine fried baked goods and packaged and sliced consumer bread in different grams.

To fulfil above mentioned goals, the research questions were formulated:

1: What change will be registered after optimalization of manufacturing and logistics process for three chosen bakery products?

2: How will the newly bought technologies help to shorten manufacturing process, decrease production costs and support increase in production?

3: Will the manufacturing process be more effective after human resources are moved to another parts of production or substituted by fully automated machines?

4: Will the investment in manufacturing and logistics process be profitable?

For collecting and analyzing data was used the method of observation, for optimization of logistics and production process is used method of network analysis (CPM, PERT), which are used to examine or manage complex processes to determine the timing and continuity of operations and activities, including time reserves and determination of optimal course of the process with respect to the use of

resources, means and costs. The result of the time analysis was the determinations of the critical path, i.e. the longest route in the network where the activities lie on it do not have any time reserves. Total time reserves indicate for how many time units can be shift the start of the duration of the activity or extend the period without endangering the deadline for completing the aggregate process.

The Method of Critical Path defines individual activities and nodes that point to the moment of initiation or termination of one or more of the partial activities that associate it, when each activity has a fixed duration and its sequence. The Method of Critical Path assumes that the duration of the activity is known, i.e. the following activities can be counted only after the previous ones have been terminated. When calculating the total duration of a sequence of activities, different paths are available (branches). In the network diagram, so-called fictional activities with duration of 0 are designed to keep the sequence of particular activities by combining individual branches. The duration of the aggregate project is calculated by counting the duration of subsequent activities on individual paths from the input node, i.e. the earliest possible start which is equal to 0. If more activities are involved in the node, the duration to the earliest possible start is counting which show the highest value. The longest branch is the critical path without time reserves. For the critical path, the earliest possible beginning is at the same time the latest possible beginning, and the earliest possible end is at the same time the latest possible end. Delay of any activity on a critical path causes delay of whole process. The subject of network analysis is particular activities on the critical paths, where the possibilities of possible shortening are identified. The total time reserve of the activity is calculated by the difference between the latest admissible end of activity and the earliest possible beginning of the activity in relation to the duration of the activity when the activities on critical path have a zero time reserve.

The basis of the PERT method (Evaluation and Review Technique) is a network chart that can be determined the optimal timetable of the progress of complex activities and their monitoring. The PERT method enable determine the duration of a project. The larger the project is, the longer is duration of the project. The longer the plan, the higher the degree of uncertainty, the higher the risk associated with the implementation of the project.

The duration of a project can only be estimated with a certain probability, so are for each activity consider three time options within the so-called optimistic estimation, when time is reached in particularly favourable conditions, i.e. it is assumed that the activity cannot end in a shorter time; the modal estimation, i.e. the time that is most commonly reached in normal conditions and the pessimistic estimate, i.e. the time that is expected in particularly unfavourable conditions, and it is predicted that it can only be exceeded in disaster situations.

Based on the determination of the duration of the activity, it is possible to calculate the mean duration of the activity, i.e. the mean value of the activity T and the value of the contradiction R = $\left(\frac{c-a}{6}\right)^2$.

By the sum of the average duration of the activity on the critical path can be obtained the total average duration of the project activity. The actual duration of the project is evaluated by the total scatter, which is defined by the sum of the scatters of critical activities. These additional options offered by the PERT method can only be used if the implementer is able to predict and interpret the achieved probability in a time model.

The Return of Investment (ROI) method measures the profitability of total invested capital. It is used to measure company's overall efficiency, gainful ability, or production power.

$$\mathrm{ROI} = \frac{\text{operating profit} - \text{initial investment}}{\text{initial investment}} * 100$$

The ROI characterizes the overall profitability of capital regardless from which sources were business activities financing.

The payback period of the investment reflects the time for which the cash incomes from the investment are equal to the initial capital expenditure on the investment.

$$\mathrm{T} = \text{investment cost/cash flow (annual)}$$

V. RESULTS

Project management is unlikely without the support of supportive tools, and their level of involvement should be proportional to the size of the organization's project management. The selection and implementation of appropriate project management tools has a number of benefits for the organization, including the standardization of management processes supporting a larger number of implemented projects, objective decision making on the basis of accurate and available information, as well as satisfaction from end-customers/ users [53]. Programme MS Project allows you to manage and organize individual project activities in a time interface from the start date of the project or its completion. When we start the project on the day when we begin the project, the other fields serve to define the basic project borders, respectively to evaluate the current state of the project. The resource calendar shows working time of working resources in the case of morning and afternoon shift or standard time or night or 24 hour shift. By setting the calendar, we define the working time of the project and the time in which the project will be realized, i.e. years, months, days, hours, and minutes as short and long periods of time. We also create interdependencies between individual processes, or define the subsequent assignment of partial project tasks. In the programme MS Project, we interpret individual production operations of the technological process at bakery products production of fine dough, such as mixing dough, ripening, raising, shaping, filling, baking, cooling, packaging and slicing, with the individual operations have to be respected before the product is finished and distributed to a direct consumer. Another operation is to set up individual processes for a selected type of bakery products, at e.g. fine risen bakery products such as cakes, poppy cakes, sweet rolls, turnovers or fine fried bakery products such as donuts and doughnut, but also B bread 1200 g, 450g and BK 1200 bread g, 450 g, 250 g, and BK consumer bread 800 g. In the programme MS Project we also define automatic conversion of data of task name, duration, start and end dates. As

production processes merge, it is necessary to set the individual predecessors to the previous steps, for example, the precursor of the ripening of the bakery products is mixing before the rising and ripening.

A. Critical Path in the Project

Projects usually have one critical path. Other sequences of tasks are called uncritical and, unlike critical paths, have no direct effect on the completion date of the project. While the delay of task on the critical path is reflected in the extension of the overall duration of the project, at the non-critical sequences of the tasks areise depletion the time reserve and the duration of the project does not change. Critical path application in MS Project is set automatically; critical tasks are highlighted in red colour. The critical path is most often displayed using the Gannt chart as a network graph. The present paper took into account three production phases of the bakery process, where the first phase was implemented for fine bakery products; the second for fine fried bakery products and the third for consume bread. Graphically, three timelines were mapped by type of bakery products, three critical paths in a network diagram, and three critical paths in the Gannt chart.

1) Critical Path of Fine Bakery Products

The Critical Path of fine bread was started by the process of mixing, ripening and rising. Bakery processes have been defined in mutual sequence in order not to overlap or affect, as they have the prescribed mixing, ripening and rising time. The baking and cooling process can not be affected due to set time of the baking and cooling. By Critical Paths lasting the longest were processes of shaping, filling and packaging. The process of shaping and filling was done manually in a small workshop where the workers molded and filled the cakes and then distributed them to the shelf stand and the baked in oven. After the cooling, process followed the packaging process, which is semi-automatic. The Critical Path through this process has been completed.

2) Critical Path of Fine Fried Bakery Products

At fine fried bakery products, the processes started by mixing, ripening, rising, machine-baking, baking in the baking pan, hand filling and cooling on the roast, i.e. by cooling in a separate room where the fine fried bakery products were then packaged and labeled.

For the Critical Path at fine fried bakery products was considered the process of filling of fine fried bakery prodcuts, since it was done manually by human power on the electric filler. The baking process was also marked as critical, as there was only one pan available, through which a limited number of baking was possible. The Critical Path was completed by the packing process.

3) Critical Path of Consumer Bread

The production process of consumer bread B and BK started the same way as with fine bakery goods or fine fried bakery good by mixing, ripening, rising, shaping, i.e. the loaves were molded automatically by the machine. The baking and cooling of the bread at interior crumb 35 ° C was left loosely in a separate room. The final production phase of consumer bread was again the process of packaging and slicing.

The Critical Path of consumer bread has been identified in the baking process, which can not be completely influenced since there are strictly defined minutes to baking of bread on the bread line. Another Critical Path was marked the cooling process, because it can not be completely influenced. A third Critical Path was identified the process of packaging and slicing of consumer bread.

VI. Discussion

A. Optimization of the Production Process of Fine Bakery Products, Fine Fried Bakery Products and Consumer Bread

Optimizing the production process of fine bakery products, fine fried bakery products and consumer bread was solving by purchasing new production technologies to shorten the production process, reduce production costs, and support production growth. The original length of the production process for fine bakery products was 478 minutes; fine fried bakery products 963 minutes and consumer bread 480, 5 minutes.

The first process, in which was identified the Critical Path in the production of fine bakery products, was the manual shaping process carried out by four employees who manually molded particular pieces of cakes, poppy cakes, sweet rolls and turnovers. In order to reduce labour costs and limit the physically demanding and strenuous work was bought a fully automated machine to molding and filling of fine dough from mark Mimac Multiform Line SP, which hopper of dough and filling individualy dosed but also shaped. To manupulation with this magine mployees were needed from the original four, i.e. the programmer and the dough feeder. Another Critical Path that can be influenced at fine bakery products was a packing machine that packed the bakery products after cooling. When purchasing a Ree Flow 4S packing machine, the three packaging phases of processes at the fine bakery products, the fine fried bakery products and the consumer bread were accelerated. The packaging machine automatically cuts and packs all bakery products.

The second process, in which the Critical Path of making fine fried bakery products was described, was the process of baking (frying) and filling. In order to increase the output and volume of the bakery products was bought fried hinged electric and self-closing pan with a capacity of 120 liters. The current pan was served by one worker who put the dough into the pan or it manually filled with the creams and produced doughnuts. This worker was able to serve the second, newly purchased frying pan by putting the dough into the original but also to the new frying pan.

The Critical Path was further defined in the process of filling fine fried bakery products, especially for donuts that were filled by hand. The employee filled the filler and skewered the donut on the needle, which he pressed to fill each donut separately. When purchasing a machine with automatic needles which handled the bakery products itself, the human power was saved, which was only needed when picking and then loading into crates and cartons. Can not be forgot the Critical Path at fine fried bakery products also in

the packing process (the packing machine Ree Flow 4S was purchased).

The third process, in which was characterized Critical Path, was the production of consumer bread B and BK in weights of 1200 g, 450 g, 250 g and 800 g, in packing and slicing processes which coordinated the packing machine Ree Flow 4S.

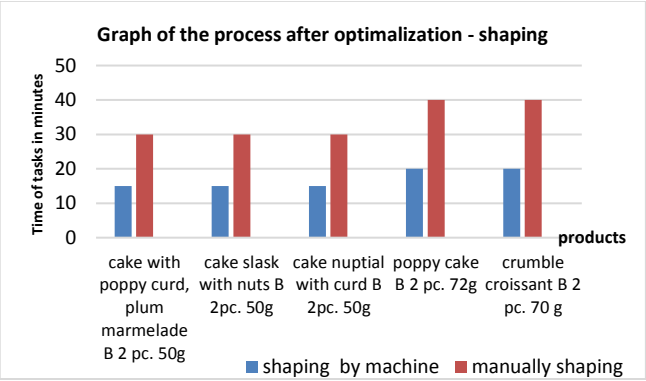

Fig. 1. Graph of the process after optimalization – shaping. *(source: author)*

As part of the first optimization of the fine bakery products shaping process by purchasing a fully automated machine, the process duration was shortened from the original 130 minutes/ 4 workers to 65 minutes/ 2 workers. You can see this optimalization in Fig. 1. When the Ree Flow 4S packaging machine was purchased and its application in the packaging process, the packaging time was shortened by 83 minutes. The need of operation for packing line has increased from 2 to 4 employees. After the packaging process was completed, the Critical Path was closed, and the other was no longer followed. Packaging process you can see in Fig. 2.

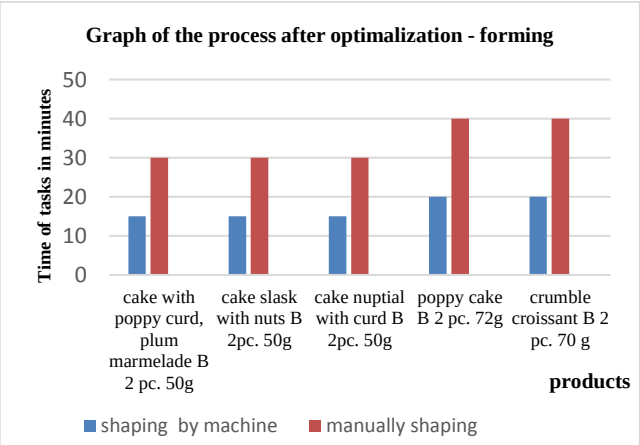

Fig. 2. Graph of the proces after optimalization – packaging. (source: author)

The first process, in which was described the Critical Path at fine fried bakery products, was the process of baking (frying) and filling. After purchasing an automatic 120-litre frying pan, the production capacity increased the process of frying and filling with an automated needle was increased. You can see this information in Fig. 3.

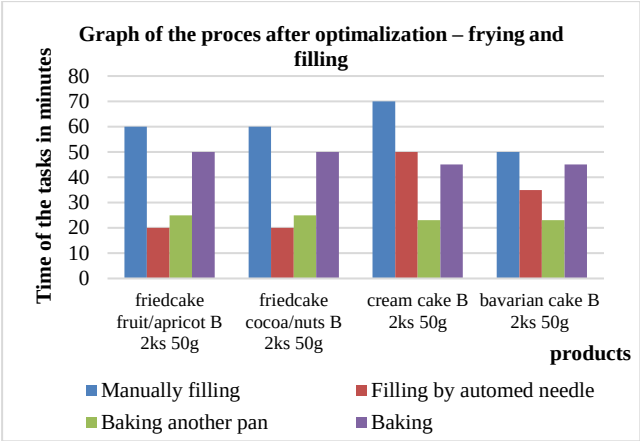

Fig. 3. Graph of the proces after optimalization – frying and filling. *(source: author)*

After the addition of the frying pan and the automatic filler to the baking (frying) and filling process by automated needle, the baking time of fine fried bakery products was shortened by 94 minutes and filling time by the automated needle was shortened to 55 minutes from the original 107 minutes.

The final, graphically illustrated was the process of packaging and slicing of consumer bread B and BK, which Critical Paths were identified in the process of mixing, ripening, raising, shaping and baking that can not be influenced. For the influential Critical Path at consumer bread was identified packaging and slicing process.

Fig. 4. illustrates the optimization of the packaging and slicing process of consumer bread after optimizing the production process by purchasing the packaging machine Ree Flow 4S.

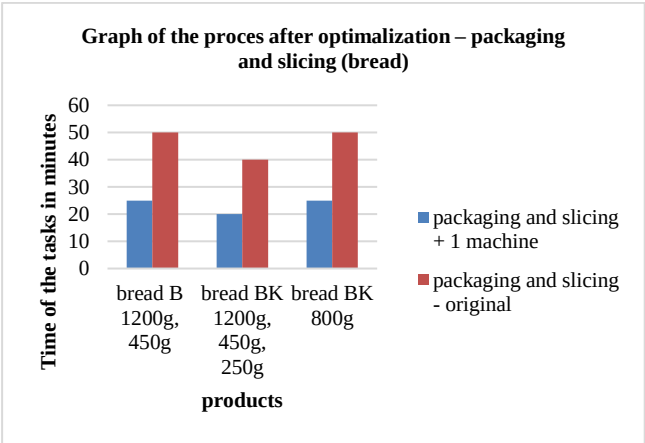

Fig. 4. Graph of the proces after optimalization – packaging and slicing (bread). *(source: author)*

The time of packing and slicing of consumer bread was reduced after the optimization of the production process from the original 140 minutes to 70 minutes. You can see this in Fig. 4.

The production process timeline before and after optimizing the production of bakery products that show a

distinct time saving for individual production processes that have been gradually optimized, for example in the process of packaging and slicing consumer bread by 70 minutes, in the process of packaging of fine bakery products by 83 minutes, in the process of shaping fine bakery products by purchasing the Ree Flow 4S machine the process was shortened by 65 minutes, in process of baking (frying) of fine bakery products the time was saved by 94 minutes, in the process of filling the fried bakery products was shortened by 107 minutes and in the process of packing of fine fried bakery products was calculated time saving to 55 minutes. These savings have been favorably influenced the processes of optimizing of the production of bakery products with the consequent increase in production volume by optimizing logistics and production processes [54] (Fig. 5).

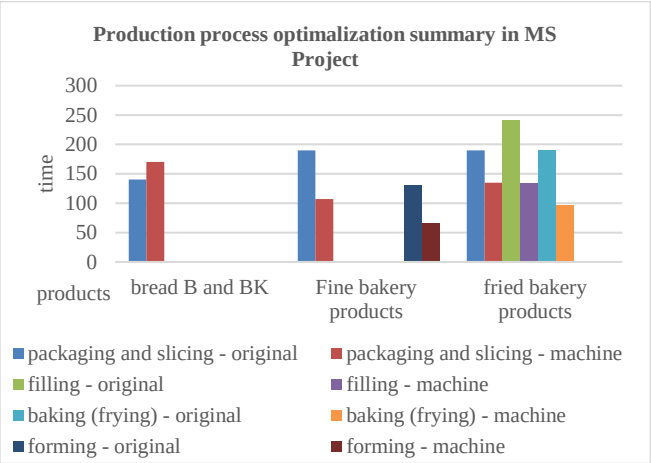

Fig. 5. Production process optimalization summary in MS Project. *(source: author)*

VII. CONCLUSION

The bakery market in the Czech Republic is very specific. Over the past twenty years, the bakery has experienced dynamic progress. The sector is private, largely dominated by Czech capital [55]. The production is provided by 60 large industrial bakeries and approximately 700 medium and small place of business. Renewed craft bakeries have supplemented and revived the offer of industrial bakeries, with new technologies, raw materials and ingredients baker's response to a rapidly changing market environment and consumer preferences. Although bread and bakery products produce about 700 bakeries, the retail chains have chosen as a competitive advantage high quality, freshness, shopping convenience and good price through it they gain customers who prefer hours, freshness and availability, thus placing their own bakeries in the shops of retail chains, which bakery products produce or bake semi-finished product. Baker manufacturers have realized the need to change their strategy in the fight for the customer, they set up their own stores to attract the customer through quality fresh goods to their side and maintain their loyalty and regularity of purchases [56]. The competitive ring of super and hypermarkets in retail chains and bakeries has a beneficial impact on consumers with regard to the products offered, a high proportion of fresh unpackaged goods as well as customer service and low prices as the bread and pastry offer on the Czech bakery market is one of the best in Europe [57]. Of course there are fresh, unpacked bakery products on the marketplace seven days a week, packaged abroad, mostly chemically preserved. Favourable is also considerably lower price for customer than for comparable foreign products, e.g. 1 kilogramme of bread in the Czech Republic corresponds to 60 % of the price of 1 litre of petrol abroad. In Germany and Austria, 1 kilogramme of bread in baker's shops is worth at least 2 €, which is 50 % more expensive than 1 litre of petrol. The quality of bread and bakery products is very important for consumers, with the increasing purchasing power of the population increasing the number of buyers who are willing to pay for higher quality. There are also a growing number of customers who buy in bakery shops or regional producers. Thanks to the expansion of the bakery shop network, the rich offer of local specialties, gastronomic development and cottager excursions are awaken „Czech product patriotism", local bakeries are being built. Increased interest is in split pieces or loaves of smaller weight, the purchase of whole loaves is in decline. Almost a third of the bread assortment is made up of special types that differ in shape, weight, and non-traditional raw materials. The King of regular bakery products is a common fat roll, the best-selling bakery product on the Czech market, similarly to different types of rolls, bagets or French breads. Customers increasingly appreciate the high proportion of high-quality raw materials and fillings in fine bakery products. In terms of taste, it is popular with poppy, curd and nuts. For sweet pastries, a healthier version of bakery products is preferred.

The current trend is the „convenience" of purchasing and profiling products for the specific needs of the target customer groups. Due to the flexible forms of jobs and changes in the lifestyle of the population, the demand for bakery products of fast food, such as segments of bakery products for grilling, specialty products for so-called singles or families with lower consumption of houshold, is increasing. People often eat in a „trot", is is also changing the style of shopping, receding from traditional, large, weekly purchases to partial, daily, smaller purchases. Manufactors are reactiong to the purchase changes that they offer to consumers a variety poducts with smaller weight, especially packaged or sliced, often with extended shelf-life time. This trend positively affects consumers in terms of limited waste of bread and bakery products. There is a growing demand for bread with a higher proportion of rye flour, whole grains and more grain breads, which prefer in large and industrial agglomerations with higher purchasing power consumers whose priority is a healthy lifestyle. From the point of view of customer care and own health, the demand for dark bakery products with higher fiber content is growing, but also there is increasing demand for yeast bread with a higher proportion of rye flour. The target customers of the healthy nutrition segment are women, younger generation - students, families with higher household incomes, as well as people who prefer active movement and a healthy lifestyle [58]. So called superfoods are shaped, i.e. functional foods with a high proportion of nutrients that are not harmful to health, benefical to the body by increasing energy, vitality, strength, or help to detoxification. They contain higher amounts of vitamins, minerals, antioxidants, enzymes, proteins, essential fatty acids, trace elements and fiber.

Popular are bakery products with chia seeds, but also products marked without „E" and gluten-free products.

Delivering food and bakery products by specialized home delivery companies is becoming more and more popular at customer who are innovative, are looking for new ways and more affordable on-line forms of purchase of bakery products online. Interest in new service is growing, fast-moving goods are booming. Claims on food production are rising with the pace of production and pressure at low cost while retaining quality. There is an increasing interest in automation of packaging and palletizing of food, which is advantageous in the long term, reduces production costs, increases competitiveness, and enables the growth of industrial production. Investing in industrial robots with a long lifetime is returning and becoming more affordable even for small and medium businesses. Robots are able to work continuously, quickly and almost flawlessly. They hold all work operation from packing to foil to packaging in a protective or modified atmosphere. Thanks to keeping the hygienic certification parameters for working with fresh and unprocessed products were improved the hygiene of operation during handling or automatic palletizing with non-human products while keeping the quality of the offered product. Automation and robotization in the food industry predetermines better quality control of used raw materials and food quality standardization. The development of multi-purpose and industrial robots co-operate with people will be one of the main trends in the coming years, with the return of production to home countries as a result of Industry 4.0, as the prediction of the robot price will continue to decline by 2025, but year-on-year performance will grow by 5 %.

In addition to telematics, there are a number of more or less advanced information technologies, used in transport processes in the enterprise: - Detectors or sensors, make possible to remote measurements of the state of means of transport, - Systems of terrestrial and satellite communications enable the transmission of information over long distances, - The aim of the contriburion was to highlight the possibilities of increasing the volume of production by optimizing logistics and production processes in order to increase the demand for three types of bakery products, i.e. fine packaged bakery products, fine fried bakery products and packaged and sliced consumer bread in different grams. The Critical Paths of bakery products and manufacturing processes were graphically depicted in MS Project application. After optimizing logistics and production processes, new measures and solutions to the given situation were recommended, with the emphasis on increasing the number of new technological devices with higher capacity performance. The machine for production and shaping of fine bakery products called A Mimac Multiform Line SP was purchased to reduce the labour costs of two production workers, accelerating the production process by 65 minutes with an increase of 50 %. The other machine was the Ree Flow 4S packaging line, which is designed for all bakery products, in which can be shortened production process by 70 minutes, e.g. for bread B and BK. The time saved in the process of packaging of fine bakery products was 83 minutes, at fine fried bakery products were shortened by 55 minutes. With the purchase of a new packaing line, two more bakery products were sliced and packaged. The third, newly purchased machine was a 120-litre automatic frying pan. Purchasing this machine was time of the frying shortened by 94 minutes. At the last purchased machine, i.e. automatic filler of fried bakery products, the filling was shortened by 107 minutes. In a shortened time was fried and filled from the original 400 pieces of fine fried bakery products 1200 pieces, i.e. 800 pieces more. The operating costs for the purchase of all four machines amounted to CZK 120,000. Payroll costs were defined to one worker because the newly purchased frying pan was served by the same worker who was until the present control the original frying pan. Another worker was required to get for a new donut filling line. Thanks to the optimization of the production process, workers were transferred from the shaping to packaging line and at the same time to increase the production volume for the bakery products: Fine bakery products for ca. 400 pcs/day, the average selling price per piece was 10, - CZK/pcs, i.e. 4000, - CZK/1 day. Line for shaping of fine bakery products was in operation 6 days/week, the annual yield was quoted in cash at 1.248 000, - CZK/year. Fine fried bakery productions for ca. 1000 pcs/day, average selling price per piece was 4,70, - CZK/pcs. Total daily yield was 4700, - CZK/1 day. The fine fried bakery productions line was in operation 6 days/week, the annual yield was quoted in cash at CZK 1.508 700 CZK/year. The packing line for consumer bread produced, on the basis of an increased demand, 400 pcs/day, the average selling price per piece was 21, - CZK/pcs, i.e. 8400, - CZK/1 day. The packing line was in operation 7 days a week, with the exception of public holidays in the number of 8 days/year, the annual yield was quoted in cash at 2.998 800 CZK/year. The total income was 5.755 500 CZK/year. The entry costs for the purchase and operation of four machines were: Mimic Multiform Line SP (CZK 699 000, -), Ree Flow S4 packing line (CZK 2.199 000, -), hinged frying pan 120-litre (263 588, donut filling machine (CZK 189,300, -). Operating costs (CZK120 000, -), wage costs (273 365, -), total costs 3.744 253, - CZK.

Based on the entry price of investments and the achieved yields in the context of increased production volume and optimization of the logistics and production process, an economic evaluation of the investment was proposed using the ROI method and the return on investment time.

$$\mathrm{ROI} = \frac{\text{operating profit} - \text{initial investment}}{\text{initial investment}} * 100$$

$$\mathrm{ROI} = \frac{5\,755\,500 - 3\,744\,253}{3\,744\,253} * 100 = 53{,}7\%$$

Return on investment was calculated at a percentage of 53,7 %.

The return on investment time influenced by the relationship between total investment (IN) and cash flow (CF) was defined at 0,65 year, i.e. 237 days.

$$\mathrm{T} = \frac{\mathrm{IN}}{\mathrm{CF}}$$

The return on investment time:

$$T = \frac{3\ 744\ 253}{5\ 755\ 500}$$
$$T = 0{,}65 \text{ year (237 days)}$$

With a total annual income of CZK 5.755 500 and a total investment cost of CZK 3.744 253, the return on investment was 53, 7 %, which is a profitable investment. The return on investment time at purchased production technologies was 0, 65 years, i.e. 237 days. Suggested ideas and measures have been found to be optimal according to company management, cost-effective, economically and investment-friendly, with higher added value.

DECLARATION OF CONFLICTING INTERESTS

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