MODERN SYSTEM APPROACHES IN MANAGEMENT OF FINALIZATION PHASE OF PRODUCT PERFORMANCE VERTICALS

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Abstract. This paper is based on the authors' collaboration with the regional brewery "TAMBOR". The specific conditions of the beer production led to the modern concept of management in order to optimize dispatch of the information flow in relation to the business of suppliers and customers. This approach has led to real improvement of the information management. Finalizing of the performance vertical of the product is designed and based on high quality of beer production. Unlike conventional breweries, where the process of the production management and its technology are base oriented on complex automated manufacturing systems using computer technology, the researched object is trying to return to the traditional brewing technology with parallel connection to digital data processing. These specifics define the degree of uniqueness of the examined object not only in the Czech Republic but also in the whole Central Europe. The problem is concentrated in a number of positive aspects that improve not only the temporal and spatial aspects of the material circulation in the finalization stage, but also significant cost savings and labor resources. Based on the cooperation with the authors of the article and the success of marketing there is the interest about inventively oriented construction, which is prospectively analyzed using aggregates of different quantitative methods, including a special application of the generalized distribution problem for the analysis of the capacity of brew house tankers. The paper also aggregates a form of the potential use of quantitative techniques in the manufacturing process and finalization of production, in particular: a) multicriteria analysis of the production program, b) model of the inventory and the optimization of material c) systemic model of production economy.

Keywords: multi-criteria analysis, information model inventory, optimization of production structure, development of system dynamics simulation, identification using bar code.

Introduction

The research object brewery "TAMBOR", located in eastern Bohemia (Dvur Kralove nad Labem), was founded about 6 years ago as a private brewery. The concept of the brewery was focused on the optimization of the production technology while minimizing the operational areas, which represent about 7600 m^2. An important aspect is the high quality own water source, which has all the parameters of the "infant" spring water at about 16.5 x sec^{-1}. This source is implemented by the artesian well with the depth of 126 m and is located in the area of the brewery.

This resource is essential for the company advancement not only to threefold increase in the production of beer in all its variations with differentiation for the summer and winter demand by marketing, but also for the planned implementation of the additional production of the whole structure of soft drinks, expected in the subsequent time over the next three years after the completion of the expansion of the brewery and building a new brew house, including new bottles. The significant specifics of the brewery "TAMBOR" include some factual aspects that define its uniqueness. These are as follows.

a) High quality beer.
b) Optimizing the role of the human factor (i.e., activity and decision-making in own brewing technology), in relation to functional information network of the investigated object "TAMBOR".
c) The system of industrial relations based on the concept of individual sources of the main input factors:

   1 – malt which is drawn from a specialized private producer of malt, not from large commercial malt operating in the Czech Republic;
   2 – collection of granular dried hops (hops of high quality) again from a private producer from Slansky-Saaz area.

Note: Both suppliers not only guarantee high quality levels of both products, but also demonstrate the identification of the sent supplies.

d) The brewery does not use caramel coloring or other dyes and distinctive timbre beer, just only its own production technology.

e) The brewery also uses different hop extracts in the form of paste, which has underscored its uniqueness in the country.

f) The quality of beer is the function of the observance of the technological process, while maintaining the complex biological properties of the output, with the perspective focusing on the implementation:

f1 – unfiltered beer;

f2 – unpasteurized beer observing a high content of vitamins.

g) The principle of optimizing the circulating material is based on the following aspects:

g1 – in cooperation with the production of brewery barrels are shipped with different variations of barrels in various sizes;

g2 – each barrel has its own bar code label that identifies the temporal and spatial turnover, including the type of beer and customers in the information system [1].

Note: This aspect of the modern approach proved in minimizing the time of the barrels remaining by the customers and minimized the cost of the subsequent commissioning barrels for further finalization cycle. Using high-tech approach brewery owner and brewer of quality, it was possible to implement cooperation in the use of the system analysis and quantitative methods, which are the subject of the present paper [2].

Extended to the model of oriented quantitative analysis is the investment space of possible technical-technological development of the company.

The system biologically oriented product-technological quantification process is based on the concept of stochastic behavior of different types of activities. The long-term goal is to create a comprehensive hybrid model system oriented in relation to the available information system and accounting. The complexity of the concept of the hybrid system currently requires its segmentation into individual sub semistructuralized issues that affect the economy as a whole [3].

This includes in particular as indicated in the introduction the high quality compliance beer produced in all variants.

The authors wish to point out the four key factors of production:

F1 – maximum quality input malt from guaranteed sources;

F2 – maximum quality INPUT dried hops (Saaz) in compressed form. Brewery does not use hop granules, pastes or extracts;

F3 – high quality water (own source type infant water);

F4 – combined computer-controlled technology of the control and the decision inputs responsible brewer.

From these considerations the examined object is among the objects with atypical beer production not only in the Czech Republic.

The quantitative analysis of the structure production due to the complexity of the hybrid modeling system requires a combination of different approaches of model information [4].

Materials and methods

The methodology is based on the solution of the investigated object, which includes expanding the production variants of production. The solution methodology has been implemented since 2010 following the sequence of methodological steps.

a) Analysis of the existing production structures;

b) Analysis of potential production options;

c) Proposed investment interventions in the productivity structure;

d) Quantitative modeling of individual segments of production.

To meet the specified targets purposefully oriented methodology combined knowledge base of well known, statistical facts, and modern tools of quantitative analysis were chosen.

On the basis of the formulated problem the system structuring concept factors involved in the problem were defined, including the determination of the basic predication, individual factors were treated as intrusions using the software product MCA KOSA. In constructing the multi-criteria analysis model, eight possible alternatives in decision making by primary agricultural producers were chosen. These alternatives were evaluated from the perspective of 14 criteria. The following multi-criteria analysis matrix and legend in Table 3 show the relationship between the decision making alternatives.

Due to the limitations of this paper, five basic methods of multi-criteria analysis were chosen for the actual calculation, i.e., AGREPREF, weighted sum, TOPSYS, ORESTE and MAPAC.

Note: the methodologies used were the key segments showing several alternative approaches for meeting the highest possible quality of production also creating space for minimizing the operating costs.

Results and discussion

In the course of this issue the complexity of creating a hybrid informative model system for the needs of the decision-making process of the object is clearly demonstrated.

The basic problem is the source of information accounting divergence, including the concepts, balance sheet and “Profit and Loss” in the relation to the structure of partial parametric indicators are drawn from two principal aspects.

a) As an objective cut-economic accounting system investigated object to analysis date.
b) Modification of these parameters and information system support for the operational management decisions and medium businesses.
c) Between these two aspects there is a sufficient degree of analogy. From this perspective, the management company essentially uses the structure of support and information resources related to the production technology and the implementation conditions of final production.

The results achieved show the need for parametric cooperation, especially between the following groups of sub-processes. These include:

a) Minimising the cost of delivery of the final product in its various forms (e.g., barrels 10, 30, 50 liter volume). Aluminium casks are factory supplied with debossed and digital code. The problem is handled by the multiple orbital problem with time and capacity constraints for the region and the system of customers so as to minimize the distribution costs as a whole.
b) Using the digitized bar code on each barrel with a perfect record information about the barrel including the structure of the following characteristics:

   K1 – barrel washing date and disinfection.

   K2 – respective type of beer, including the durability of possible consumption.

   K3 – exit date of each barrel as fulfillment of quality business cooperation.

   K4 – identification of the time between the delay of the barrel to the implementation and delivery of the contractually specified interval, return of the empty container, i.e., the barrel back to the supplier.

   K5 – minimize the cost of washing and sterilizing drums since returning to refilling the barrel respective batches of beer [5].

Note: it can be concluded that high quality information system solutions based on direct indication of the bar codes and the selected structure complete database of individual barrel flexible solution allows the subsequent four key issues.

1) material incentives of the customers, i.e., restaurants on the timeliness of return of packaging material,
2) cost minimization of transportation and of input washing disinfection barrels,

3) monitoring and optimizing the sales of beer with minimum delay from the exhibition after implementation,
4) appropriate information system enables dynamic cyclical model theories stocks, i.e., behavior deadlines and sampling barrels [6].

This is the sense of stochastic derivative of the Willson model that minimizes the need for supply of barrels for the product implementation [7]. Individual tasks were implemented in the system quantitatively hybrid computing model of the system. For this reason, the results presented in the table only basic multicriteria analysis brewery Tambor at 14 set criteria and scale (absolute value) of quantified values of these criteria as a basic model of multi-criteria analysis. To set seven variants of beer scales were altered as an option perspectivity analysis. Individual criteria are defined and addressed in the ratio and change the weight of these criteria using five basic methods, which are known and available in the literature. The resulting table indicates a relatively high degree of stability of production, which is further dealt with in the hybrid model system.

The MCA model inputs and results are summarized in Tables 1 and 2.

Table 1

MCA model inputs

Variant	Criteria													
	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}
V_1	0.2	5	7	5	0.4	1	0.7	4	5	0.1	1	2	1	2.3
V_2	0.05	5	4	3	0.6	1.3	0.8	5	5	0.15	1	3	1.3	2.9
V_3	0.1	3	3	4	0.4	1.4	0.8	6	3	0.1	2	5	1.2	2.8
V_4	0.1	2	4	4	0.2	1.45	0.9	5	5	0.13	2	7	1.5	3.1
V_5	0.35	1	5	6	0.7	1.5	1	5	7	0.11	3	9	1.2	1.8
V_6	0.15	1	6	7	0.6	1.55	1.1	6	7	0.1	3	9	1.1	1.9
V_7	0.05	3	7	2	0.3	1.6	1	7	5	0.12	4	5	1.4	2.1
TYP	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MAX	MIN	MIN	MAX	MAX	MIN	MAX
Weigh I.	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
Weight II.	0.1	0.04	0.05	0.1	0.1	0.06	0.12	0.03	0.04	0.12	0.03	0.04	0.08	0.09

- K_1 – Request production quantity – maximizing
- K_2 – Pasteurization – minimization
- K_3 – DT (life, days) – maximizing
- K_4 – Inquiry rate – maximize
- K_5 – VP (balance demand; Pi-probability) – maximizing
- K_6 – VN (production costs CZK·hl^{-1}) – minimization
- K_7 – RC (strike price; CZK·hl^{-1}) – maximizing
- K_8 – ZZ (profitable basis; RC-VN; CZK·hl^{-1}) – maximizing
- K_9 – ExT (forwarding type – bottles, plastic drums, metal barrels, volume 10, 30, 50 l) – minimization
- K_{10} – Logistics costs (within the brewery; CZK·hl^{-1}) – minimization
- K_{11} – TMskl. (time possible storage; days) – maximizing
- K_{12} – Ev. ob. (evidence packaging) – maximizing
- K_{13} – Cost distribution (on demand) – minimization
- K_{14} – Expected demand – maximizing

V_1 – type 10° light
V_2 – type 10° dark
V_3 – type 11° light
V_4 – type 11° dark
V_5 – type 12° light
V_6 – type 12° dark
V_7 – type 13°

Table 2

MCA model results

Variant	Method AGREPREF		Method weighted sum		MethodTOPSYS		Method ORESTE		Method MAPPAC	
	Index Dh	Rank	Benefit	Order	Distance	Order	Value	Rank	Sigma	Class
V_1	0	3	0.456044	5	0.554613	1	698	4	1.678586	4
V_2	-2	6	0.301596	7	0.336888	7	888	7	0	7
V_3	-1	5	0.489129	3	0.50973	4	673	3	2.51158	3
V_4	-2	6	0.39983	6	0.372951	6	787	6	0.699368	6
V_5	2	2	0.615476	2	0.542826	2	564	2	3.420544	2
V_6	3	1	0.655495	1	0.511766	3	475	1	4.26935	1
V_7	0	3	0.45781	4	0.373331	5	766	5	1.170646	5

Conclusion

This paper is a partial summary of the aggregate cooperation of the Department of Systems Engineering (KSI) and the Department of Trade and Finance (KOF) to the researched object. Synthetic conclusions contain the results of this cooperation when the analyzed object is one of the unique modern information technology and traditional approaches to the production of beer as return to the original technology.

Availability progressive information system resources hops and malt in the traditional form along with a source of high quality water is the foundation of business success of the company business plan, which envisages an expansion of output of beer for about 8-10 times the current state during 3-5 years. The investment plans according to the analysis of the production structure are based on detailed quantification analysis of the individual segments. This paper is a methodological document of possible success of cooperation theories, operating practices and quantitative systems analysis. If we analyze the problem from a purely economic point of view, it can be seen that the production of beer in macroeconomic conditions in the Czech Republic is currently profitable.

However, if we look at the problem in terms of macroeconomic stability and systemic agricultural system, we can only come to one conclusion that partial criteria K_1-K_{14} shown in Tables 1 and 2 affect fully tracked variant types V_1-V_7 as an aspect of long-term development of the reference brewery "TAMBOR".

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