Criteria and indicators of synergistic efficiency of food industry enterprise management

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Abstract. A synergistic approach to production management is becoming fundamental in ensuring the sustainable and efficient functioning and development of organizations. The aim of the study is to substantiate the methodological toolkit for assessing the synergistic management efficiency of the food industry enterprise. The paper briefly examines the positions of individual scientists, revealing the view of modern science on understanding synergy, the sources of its origin and approaches to the extraction of synergistic effect in the economy, business, and production. As a result of generalization of the research previously presented in science, the authors clarified and systematized the factors and conditions of synergy, which are divided into two groups - internal and external. On the basis of the system of synergy factors, the article substantiates a formalized system of criteria and indicators for assessing the synergetic efficiency of managing a food industry enterprise. The paper provides an example of calculating and evaluating the proposed criteria and indicators based on materials from one of the food industry enterprises, as well as reasoning and conclusions about the future actions of the management of this enterprise. The presented system of criteria and indicators makes it possible to judge the level of synergistic efficiency of management and the degree of influence of individual factors of synergy on the financial results of the enterprise. The technique can be used by the management of enterprises in the development and substantiation of promising (medium-term) management decisions and programs for the development of enterprises.

1. Introduction

In conditions of fierce competition, attempts to ensure efficiency and competitiveness, enterprises and organizations are looking for new sources of development and growth reserves. First of all, they are associated with a synergistic effect. Opportunities for continuous improvement and simultaneous obtaining of a synergistic effect in modern science are associated with the use of a set of specific control methods aimed at bringing the control system into a harmonious state. Therefore, the search for sources and methods' substantiation of synergetic management, tools for achieving comfort and harmony in the production and business management system, criteria and indicators that allow assessing synergetic efficiency are very relevant today.

The purpose of the study was to summarize the results of leading scientists' scientific works devoted to synergism, identification and assessment of synergistic effects, as well as to substantiate the criteria and indicators of synergistic efficiency typical for the management of a manufacturing enterprise on the example of LLC Sarapul yeast brewery.
The materials and results of this study are intended to supplement and clarify modern scientific ideas about the content of synergetics, criteria and indicators for assessing the synergistic efficiency of managing food industry enterprises.

2. Materials and methods
The materials and information base of the study were the data from the official statistics of the Udmurt Republic and the Russian Federation on the results of the work of food industry organizations in general and beer producers in particular, data from Sarapul yeast brewery LLC, works of economists and practitioners dedicated to the study and assessment of synergy and synergetic business management efficiency. Monographic, computational-constructive, statistical methods, methods of economic analysis and comprehensive efficiency assessment were used as the main research methods.

3. Research results
Synergy (from the Greek sinergia - "cooperation, commonwealth") is a joint creative activity of people, as a result of which a qualitatively new group relationship is created, as well as a qualitatively new joint type of energy, the value of which exceeds the sum of the applied energies [1].

I. Ansoff defined synergy as a measure of joint effects or as “an effect capable of producing a revenue level of an integrated company in excess of the sum of the similar indicators of its separately functioning divisions, often denoted by the equation "2 + 2 = 5". He proposed a classification of synergism according to the criterion of the organization's profit components: 1) trade; 2) operational; 3) investment; 4) management synergism [11].

H. Itami considers synergism as a process of increasing the efficiency of using two types of resources [13]: physical (tangible) and invisible (intangible) assets. He introduces the concept of the "complementary effect", which is achieved by increasing the efficiency of using physical resources and reducing costs, and believes that, for all its importance, this effect is not a source of synergism as it can be easily replicated by competitors. True synergies are achieved through invisible assets such as introducing a new product to the market, new ways of working, etc.

Malyuk V.I. and Nemchinov A.M. understand the synergistic effect as "...the general effect of consistency according to a certain list of synergy factors, which is formed in this system's element both as a generator of synergy and in its receiver from other elements of the system" [8].

A feature of managerial synergetics in production is that its object is human-machine system processes. The system-process is the continuous functioning and system's change during its activity and development (performance of work, physical movement, evolution, restructuring) over time [10].

In the works of Kuznetsov B.L. 3 types of resonant (synergistic) influences (interactions) are considered: 1) temporal (cyclic and rhythmic synchronization in time) resonance, 2) spatial resonance (the formation of pulse symmetry in the state space), 3) heterogeneous synchronization (coordination in time of discrete macroscopic fluctuations in heterogeneous subsystems that make up the socio-technical systems "man - machine - external environment" [6, p. 60; 7].

The idea of synergistic management is that the process of production and products' sales is considered as a controlled system-process, providing all stages with appropriate information, resource and innovation support, as a result of which a synergistic effect is provided [10].

The methodology's substantiation for assessing the synergistic efficiency of organization and enterprise management requires the formulation of an updated list (system) of synergistic efficiency indicators of the main system-process directly creating the main product, which is transmitted to the consumer in the external environment. The main system-process of a manufacturing enterprise includes the structural elements of the production subsystem and the main business processes. It is customary to evaluate the performance indicators of any system in the context of such criteria as costs and payback (cost), results and effectiveness, effect and efficiency. As criteria for assessing business processes, it is customary to consider the criteria for the course of the process, the results of the process and customer satisfaction [3, 15, 17].
The main product of CJSC Sarapulsky yeast brewery is beer of various sorts. Therefore, the synergistic efficiency of beer production management should be considered in the context of the structural elements' performance indicators of the beer production subsystem and the indicators for assessing business processes that affect and (or) determine the costs of this product and the characteristics of the "Beer" product, that is, the product's use value, the name of the product, product stability, product life.

The main indicators of beer production efficiency can be the following: production volume per unit of time (thousand dal/day), per unit of labor input (thousand dal/thousand man-hour), per unit of production costs (thousand dal/thousand rubles), per employee (thousand dal/person), per unit area of industrial premises or used territory (thousand dal/sq.m or are), duration of the production cycle (hour/cycle), labor intensity of the production cycle (man-hour/cycle), total unit cost (thousand rubles/thousand dal), selling price (thousand rubles/thousand dal), profit per unit of production (thousand rubles/thousand dal), product profitability (thousand rubles profit/thousand rubles costs), profit per employee (thousand rubles/person), profit per unit of labor costs (thousand rubles/thousand man-hours), profit per unit of production premises or used territory (thousand rubles/sq.m or are), profit per one production cycle (thousand rubles/cycle).

Indicators of synergetic efficiency of a manufacturing enterprise are relative and depend on the following factors and conditions: 1) production and economic indicators of the effectiveness and efficiency of a particular enterprise, 2) the overall level of synergy achieved in the industry, 3) the previously achieved level of synergy of a particular enterprise in the existing production method, 4) the results and efficiency of the organization's subsystems functioning adjacent to the production subsystem, 5) the general conditions for the functioning of the production subsystem [4, 5].

As indicators of the synergistic production performance, the following indicators shown in Table 1 may be offered.

| Table 1. Indicators of synergistic production performance. |
|----------------------------------------------------------|
| Indicator name                                            | Calculation formula | Formula interpretation |
|----------------------------------------------------------|
| 1. Partial performance indicators of internal factors of production synergy |
| 1. Production equipment efficiency | \( P_{pe} = \Delta S_{eq,ij-av.} \times \Delta V_{pc}/\Delta U_{cpe} \) | \( \Delta S_{eq,ij-av.} \)- the relative change in the synergy level of production equipment on average for the considered pairs of technological processes; \( \Delta V_{pc} \)- the relative change in the volume of the production capacity of the equipment; \( \Delta U_{cpe} \)- relative change in the actual capital cost of the production equipment (correction factor) |
| 2. The efficiency of production and energy resources | \( P_{per} = \Delta S_{en,ij-av.} \times \Delta V_{gp}/\Delta U_{per} \) | \( \Delta C_{en,ij-av.} \)- the relative change in the synergy level of production and energy resources on average for the considered pairs of technological processes; \( \Delta V_{gp} \)- the relative change in the goods' production volume; \( \Delta U_{per} \)- the relative change in the volume of consumed production and energy resources (correction factor) |
| 3. Productivity of the production workforce | \( P_{pwf} = \Delta S_{qual,ij-avg.} \times \Delta V_{wp}/\Delta U_{wf} \) | \( \Delta S_{qual,ij-avg.} \)- the relative change in the level of synergy of the production workforce on average for the pairs of technological processes under consideration; \( \Delta V_{wp} \)- the relative change in the volume of goods' production; \( \Delta U_{wf} \)- relative change volume of labor input of the workforce (correction factor) |
4. The efficiency of production raw materials and materials

$$P_{prm} = \frac{\Delta S_{mat,ij-av} \cdot \Delta V_{gp}}{\Delta U_{crm}}$$

- $\Delta S_{mat,ij-av}$ - the relative change in the synergy level of production raw materials on average for the pairs of the considered technological processes;
- $\Delta V_{gp}$ - the relative change in the volume of goods' production;
- $\Delta U_{crm}$ - the relative change in the volume of consumed production raw materials (correction factor).

5. Production and functional performance

$$P_{pf} = \frac{\Delta S_{fun,ij-av} \cdot \Delta V_{gp}}{\Delta U_{pmf}}$$

- $\Delta S_{fun,ij-av}$ - the relative change in the level of production and functional synergy on average for the pairs of technological processes under consideration;
- $\Delta V_{gp}$ - the relative change in the volume of goods' production;
- $\Delta U_{pmf}$ - the relative change in the volume of labor costs for performing production management functions (correction factor).

6. Effectiveness of internal factors of production synergy

$$P_{pf} = P_{pe} \cdot P_{pf} \cdot P_{pwf} \cdot P_{prm} \cdot P_{pf}$$

II. Particular indicators of external factors’ efficiency of production synergy

1. Consumable production efficiency

$$P_{gp} = \frac{\Delta S_{cost}}{\Delta U_{cpp} \cdot \Delta U_{dp}}$$

- $\Delta S_{cost}$ - relative change in the level of production and consumption synergy;
- $\Delta U_{cpp}$ - the relative change in the level of purchasing power of consumers in the region (correction factor);
- $\Delta U_{pa}$ - relative change in the degree of product availability for customers in the retail network for reasons beyond the manufacturer (correction factor).

2. Competitive production performance

$$R_{cp} = \frac{\Delta C_{ident}}{\Delta U_{pm}}$$

- $\Delta C_{ident}$ is the relative change in the level of competitive production synergy;
- $\Delta U_{pm}$ is the relative change in the volume of the product market in the region (correction factor).

3. Social performance of production

$$R_{sp} = \frac{\Delta C_{sop}}{\Delta U_{mb}}$$

- $\Delta C_{sop}$ - the relative change in the level of social synergy of production;
- $\Delta U_{mb}$ - relative change of the average value of the material benefits per worker (specialist) in the region (correction factor).

4. Moral and psychological effectiveness of production

$$R_{mpp} = \frac{\Delta C_{psy}}{\Delta U_{mpt}}$$

- $\Delta C_{psy}$ - the relative change in the level of moral and psychological synergy of production;
- $\Delta U_{mpt}$ - the relative change in the level of moral and psychological tension in the society of the region (correction factor).

5. Innovation and investment performance of production

$$P_{iip} = \frac{\Delta S_{dev}}{\Delta U_{i}}$$

- $\Delta S_{dev}$ - the relative change in the level of innovation and investment synergy of production, $\Delta U_{i}$ - the relative change in the level of investment in the industry (correction factor).

6. Financial performance of production

$$P_{fp} = \frac{\Delta S_{fin}}{\Delta U_{fst}}$$

- $\Delta S_{fin}$ - the relative change in the level of financial production synergy, $\Delta U_{fst}$ - the relative change in the level of financial stability and self-sufficiency of commercial organizations in the industry (correction factor).
7. The effectiveness of the production material support

\[ R_{pmp} = \frac{\Delta S_{prov}}{\Delta U_{pmp}} \]

\[ \Delta S_{prov} \] - the relative change in the level of synergy in the provision of material factors, 
\[ \Delta U_{pmp} \] - the relative change in the level of material production provision of industry organizations (correction factor)

8. Anti-crisis production efficiency

\[ P_{ap} = \frac{\Delta S_{cris}}{\Delta U_{as}} \]

\[ \Delta S_{cris} \] - relative change in the level of anti-crisis production synergies, 
\[ \Delta U_{as} \] - the relative change in the anti-crisis sustainability level of organizations in the industry (correction factor)

9. The effectiveness of external synergy factors

\[ P_{ex} = \frac{P_{gp} \cdot P_{sp} \cdot P_{mpp} \cdot P_{iap} \cdot P_{fp} \cdot P_{pmp} \cdot P_{ap}}{} \]

III. Total performance of production synergy factors

\[ P_{t} = P_{in} \cdot P_{ex} \]

For the purposes of this work, the relative indicator's change means the rate of growth (decline) of the given indicator in the current period in relation to the previous one. The synergy level of the enterprise is determined by the sources (factors) of synergy, which make the synergy of the production subsystem dependent on the other subsystems of the organization with which the former is connected. The level of synergy for each factor (source) is determined by the ratio of the development level of the corresponding enterprise's subsystem with the achieved development level of this subsystem in the best enterprises of the industry [5].

In addition to the indicators' systems of synergistic production's performance listed in Table 1, the following criteria for synergistic performance and production efficiency can be calculated (Table 2).

**Table 2. Criteria for synergistic performance and production efficiency.**

| Criterion name                                             | Calculation formula | Formula interpretation |
|------------------------------------------------------------|---------------------|------------------------|
| I. Performance criteria                                    |                     |                        |
| 1. Criterion of production volume by the level of synergistic performance | \[ R_{plsp} = \frac{\Delta V_{pv}}{P_{o\%}} \] | \[ \Delta V_{pv} \] - the absolute change in the volume of production and sales of products; \[ P_{o\%} \] - the overall performance of production synergy factors in percent |
|                                                            | \[ P_{o\%} = (P_{o} - 1) \times 100 \] |                        |
| 2. Criterion of the profit mass by the synergy level        | \[ E_{psl} = \frac{\Delta P_{p}}{\Delta S_{lps\%}} \] | \[ \Delta P_{p} \] - the absolute change in the mass of profit from the production and sale of products; \[ \Delta S_{lps\%} \] - absolute change in the complex criterion of the level of production synergy in percent |
|                                                            | \[ \Delta S_{lps\%} = (S_{lps(t)} - C_{lps(t-1)}) \times 100 \] |                        |
| 3. Criterion of the profitability level by the level of synergy | \[ E_{pls} = \frac{\Delta P_{p}}{\Delta S_{lps\%}} \] | \[ \Delta P_{p} \] - absolute change in product profitability; \[ \Delta S_{lps\%} \] - absolute change in the complex criterion of the level of production synergy in percent |

Table 2 presents a system of main criteria for synergistic performance and production efficiency arising (derivating) from the main indicators of results (effectiveness) and effect (efficiency) in
production - production and sales volume, profit from product sales, product profitability. In addition to those presented in the table, additional indicators of synergetic efficiency can be formulated.

4. Discussion

Let us give an implementation example of the above presented research results based on materials from one of the well-known food industry enterprises in the Udmurt Republic. The initial calculating data and performance indicators’ calculation of the internal synergy factors of LLC Sarapul yeast brewery are presented in table 3.

Table 3. The initial calculating data and partial performance indicators' calculation of the internal production synergy factors.

| Indicator name                                                                 | 1990  | 1995  | 2000  | 2005  | 2010  | 2015  | 2018  | 2019  | 2020  | 2020 to 2019, % |
|--------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|
| 1. Production equipment efficiency                                            | 1.08  | 1.72  | 1.82  | 0.84  | 1.17  | 1.91  | 0.88  | 0.99  | 1.04  | 97              |
| 1.1 Relative change in the synergy level of production equipment              | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 100             |
| 1.2 Relative change in the volume of production capacity of equipment         | 1.03  | 0.71  | 1.11  | 1.12  | 1.06  | 1.08  | 1.02  | 0.80  | 1.04  | 101             |
| 1.3 Relative change in the real capital cost of production equipment          | 0.93  | 0.58  | 0.55  | 1.18  | 0.85  | 0.73  | 1.13  | 1.01  | 0.96  | 103             |
| 2. The efficiency of production and energy resources                          | 1.00  | 0.77  | 1.32  | 1.58  | 1.08  | 1.21  | 0.98  | 0.86  | 1.07  | 107             |
| 2.1 Relative change in the synergy level of production and energy resources   | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 100             |
| 2.2 Relative change in production volumes                                     | 1.03  | 0.54  | 1.46  | 1.78  | 1.15  | 1.30  | 1.00  | 0.69  | 1.11  | 108             |
| 2.3 Relative change in the volume of consumed production and energy resources | 1.00  | 0.77  | 1.32  | 1.58  | 1.08  | 1.21  | 0.98  | 0.86  | 1.07  | 107             |
| 3. Productivity of the production workforce                                   | 1.04  | 0.59  | 1.58  | 2.00  | 1.31  | 1.37  | 0.95  | 0.80  | 1.14  | 109             |
| 3.1 Relative change in the synergy level of the production workforce          | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 100             |
| 3.2 Relative change in production volumes                                     | 1.03  | 0.54  | 1.46  | 1.78  | 1.15  | 1.30  | 1.00  | 0.69  | 1.11  | 108             |
| 3.3 Relative change in the volume of labor input of the workforce             | 0.99  | 0.92  | 0.92  | 0.89  | 0.88  | 0.95  | 1.06  | 0.86  | 0.98  | 99              |
| 4. Efficiency of production raw materials                                     | 0.99  | 0.92  | 0.95  | 1.03  | 1.04  | 1.04  | 1.02  | 1.01  | 1.01  | 102             |
| 4.1 Relative change in the synergy level of production raw materials          | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 100             |
| 4.2 Relative change in production volumes                                     | 1.03  | 0.54  | 1.46  | 1.78  | 1.15  | 1.30  | 1.00  | 0.69  | 1.11  | 108             |
| 4.3 Relative change in the volume of consumed production raw materials        | 1.04  | 0.59  | 1.54  | 1.73  | 1.10  | 1.25  | 0.98  | 0.68  | 1.10  | 106             |
| 5. Production and functional performance                                       | 1.02  | 0.69  | 1.88  | 1.42  | 1.11  | 1.21  | 1.03  | 0.79  | 1.23  | 121             |
| 5.1 Relative change in the level of production and functional synergy         | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 100             |
| 5.2 Relative change in production volumes                                     | 1.03  | 0.54  | 1.46  | 1.78  | 1.15  | 1.30  | 1.00  | 0.69  | 1.11  | 108             |
| 5.3 Relative change in the volume of labor costs for performing production management functions | 1.01  | 0.79  | 0.78  | 1.25  | 1.03  | 1.07  | 0.97  | 0.87  | 0.90  | 89              |
The data in Table 3 indicate that, in general, partial indicators of the synergistic performance of internal production factors tend to grow, especially in recent years. Table 4 presents the initial calculating data and partial performance indicators' calculation of the external production synergy factors of the production enterprise LLC "Sarapul yeast brewery".

**Table 4.** Initial calculating data and partial performance indicators' calculation of the external production synergy factors.

| Indicator name                                                                 | 1990 1995 2000 2005 2010 2015 2018 2019 2020 2020 to 1990, % |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1. Consumable production efficiency                                            | 1.09 0.95 1.14 1.14 1.00 1.04 1.02 0.98 1.21 110                                               |
| 1.1 Relative change in the level of production and consumption synergy          | 1.04 0.54 1.46 1.78 1.07 1.00 1.00 0.69 1.11 107                                               |
| 1.2 Relative change in the level of purchasing power of consumers in the region | 0.95 0.57 1.28 1.56 1.12 0.96 0.98 0.94 0.97 102                                               |
| 1.3 Relative change in the degree of product availability for consumers in the retail network for reasons beyond the manufacturer's control | 1.00 1.00 1.00 1.00 0.95 1.00 1.00 0.75 0.95 95                                               |
| 2. Competitive production performance                                           | 0.96 0.41 0.54 1.44 1.80 0.94 0.82 0.91 0.95 98                                               |
| 2.1 Relative change in the level of competitive production synergy              | 1.00 0.50 0.57 1.56 1.84 0.92 0.82 0.93 0.98 98                                               |
| 2.2 Relative change in the volume of the product market in the region           | 1.04 1.22 1.06 1.08 1.02 0.98 1.00 1.02 1.04 100                                               |
| 3. Social performance of production                                            | 1.01 1.44 0.82 0.55 0.77 1.09 1.00 0.97 1.04 103                                               |
| 3.1 Relative change in the level of social production synergy                    | 0.97 0.88 1.12 1.18 0.93 1.08 1.00 0.94 1.03 107                                               |
| 3.2 Relative change in the average value of material benefits per worker (specialist) in the region | 0.96 0.61 1.36 2.12 1.21 0.99 1.00 0.97 0.99 103                                               |
| 4. Moral and psychological effectiveness of production                         | 1.06 1.24 0.94 1.09 1.09 1.01 1.01 1.05 1.04 99                                               |
| 4.1 Relative change in the level of moral and psychological production synergy   | 0.93 0.70 1.19 1.33 1.16 1.05 1.02 1.03 0.98 105                                               |
| 4.2 Relative change in the level of moral and psychological tension in the society of the region | 0.88 0.56 1.27 1.22 1.06 1.04 1.01 0.98 0.94 107                                               |
| 5. Innovation and investment performance of production                          | 0.96 0.56 0.73 0.74 1.42 1.20 0.77 0.81 0.73 76                                               |
| 5.1 Relative change in the level of innovation and investment synergy of production | 0.89 0.31 2.31 1.73 1.65 1.36 0.84 0.82 0.76 85                                               |
| 5.2 Relative change in the level of investment in the industry                  | 0.93 0.56 3.16 2.34 1.16 1.13 1.09 1.02 1.04 112                                               |
| 6. Financial performance of production                                          | 1.00 0.66 0.83 1.16 0.56 1.26 1.05 0.87 1.12 112                                               |
| 6.1 Relative change in the level of financial production synergy                | 1.00 0.35 1.60 2.64 0.19 1.50 1.07 0.88 1.16 116                                               |
| 6.2 Relative changes in the level of financial stability and self-sufficiency of commercial organizations in the industry | 1.00 0.52 1.92 2.27 0.34 1.19 1.02 1.01 1.03 103                                               |
| 7. The effectiveness of the production material support                         | 1.02 1.19 0.90 0.92 0.81 1.10 1.08 0.86 0.88 87                                               |
7.1 Relative change in the synergy level in the material factors' provision
7.2. Relative change in the level of production's material security of organizations in the industry
8. Anti-crisis production efficiency
8.1. Relative change in the level of anti-crisis synergy of production
8.2 Relative change in the level of anti-crisis stability of organizations in the industry

In general, the data in Table 4 indicate that the particular indicators of the synergistic performance of external production factors tended to grow until 2015, but in recent years (2018-2020) their downward trend has been outlined.

The generalized effectiveness assessment of the production synergy factors of LLC Sarapul yeast brewery is presented in Table 5.

### Table 5. Indicators of the overall performance of production synergy factors.

| Indicator name                           | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2020 to 1990, % |
|-----------------------------------------|------|------|------|------|------|------|------|-----------------|
| 1. The effectiveness of internal factors of production synergy | 1.00 | 0.97 | 1.20 | 1.05 | 0.83 | 1.25 | 1.15 | 0.87 | 88 |
| 2. The effectiveness of external factors | 0.96 | 0.91 | 0.94 | 1.62 | 0.56 | 1.28 | 1.33 | 0.97 | 65 |
| 3. Overall performance of production | 0.92 | 0.51 | 1.73 | 3.74 | 0.21 | 2.04 | 1.56 | 1.02 | 66 |
| 4. Material factors' provision          | 0.96 | 0.56 | 1.85 | 2.31 | 0.37 | 1.59 | 1.17 | 1.05 | 101 |

The overall level of synergistic production efficiency in the analyzed period has a positive trend, although in recent years its stagnation has been outlined and there even was a significant decrease in 2019. In recent years, synergetic performance has suffered due to the following reasons: 1) a decline in the competitive position of the plant in the market due to insufficient consideration of the consumer market segmentation and an insufficiently effective assortment policy, 2) a decrease and insufficient volume of investments in the modernization and development of production, 3) a decrease in stability and the effectiveness of production material support, 4) a significant drop in anti-crisis stability in 2020, 5) a significant decrease in the effectiveness of internal factors of production synergy. Thus, the decline in production efficiency is primarily due to insufficiently effective management of external factors of the production subsystem. At the same time, the extraction of the internal factors' potential of the production subsystem mainly has an upward trend except for 2019, when the management system of the internal production system factors failed (did not have time) to quickly respond to the deterioration of external production synergy factors.

### Table 6. Criteria for synergistic performance and production efficiency.

| Indicator name                           | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2018 | 2019 | 2020 | 2020 to 1990, % |
|-----------------------------------------|------|------|------|------|------|------|------|------|------|-----------------|
| 1. Criterion of the production volume by the level of synergetic performance: a) decrease in production volumes by 1%, decrease in the level of performance, thousand dal | - | 7.23 | - | - | - | 0.00 | 12.89 | - | - |
b) increase in production volume by 1% of increase in the level of performance, thousand dal

| 12.48 | 6.54 | 11.5220 | 02.578 | - | - | 99.60 | 798 |

II. Performance criteria

2. Criterion of the mass of profit by the level of synergy: a) loss of profit from sales by 1% decrease in the level of synergy, million rubles

| - | 0.31 | - | - | - | 0.57 | 0.87 | 0.97 |

b) increase in profit from sales by 1% increase in the level of synergy, million rubles

| 0.16 | 1.49 | 0.37 | 1.27 | 1.12 | - | - | - |

3. Criterion of the profitability level by the level of synergy: a) decrease in profitability by 1% decrease in the level of synergy, %

| - | 1.27 | - | - | - | 0.24 | 0.96 | 1.64 |

b) increase in profitability by 1% increase in the level of synergy, %

| 0.78 | 9.92 | 0.91 | 1.01 | 1.01 | - | - | - |

The data in Table 6 indicate a significant decrease in the level of synergistic production efficiency starting from 2015, which is a logical consequence of a decrease in the overall production synergy level and its synergistic performance. The influence of the synergy level on production efficiency has a medium-term impact (2-3 years), therefore, a decline or increase in the synergy level in a certain period of time entails a subsequent wave-like change in efficiency and effectiveness with a delay in time. At the same time, changes in performance are not always adequate with changes in efficiency, since generally even very positive results do not always simultaneously allow obtaining a positive effect (results may be ineffective or high results may be ineffective). This fact, in particular, was noted in 2020 - in conditions of a decrease in the synergy level and efficiency of beer production, the level of its effectiveness takes on a positive value.

Considering the above, the following reserves for increasing the synergetic efficiency of production in relation to beer production in the conditions of the Sarapul yeast brewery should be identified:

1) the organization of a system for managing the competitive advantages of the plant that is adequate to the requirements of the market, in particular by studying consumer requests, issues of market segmentation, improving the product range and organizing the assortment policy;

2) study of the use value of products (beer products) not only from the point of view of the plant management, but also from the point of view of each consumers' group using a particular product within the market segment to which this group of consumers belongs;

3) improving the management system for the procurement of basic raw materials, their purchases and supplies; in particular, through the conclusion of long-term agreements with manufacturers, the organization of joint projects for the production of raw materials of the required quality, redemption or equity participation in organizations producing raw materials;

4) organization of a management system for self-improvement of goods' production (Kaizen concept) by allowing or obliging ordinary workers to make periodic rationalization proposals to improve their workplace, working procedures and operations;

5) an increase in the investments' volume to the required level in the equipment modernization, the gradual automation (or robotization) of individual technological operations (or even processes), in the improvement of workplaces, and over time (at present, capacities are underutilized) - in the gradual expansion of production;

6) carry out work to ensure a consistently optimal level of financial and anti-crisis stability of production (optimal level = 1). Maintaining excessive stability is too costly or, when using own funds, it is obviously ineffective and does not give the expected effect either in the production subsystem or for the organization as a whole - if there are free funds, they need to be invested in the development of the organization's production or in new external projects. Significant fluctuations in financial and anti-crisis stability can lead to greater mistrust on the part of counterparties, as well as their closer attention to the financial subsystem of the organization.
The implementation of these reserves, which, in particular, are listed in decreasing order of their importance, will comprehensively allow achieving the maximum synergy level in beer production and, accordingly, realizing the maximum potential for the effectiveness and efficiency of the production subsystem. In particular, the maximum profitability level of beer production in the existing market conditions can reach up to 100%.

The system of criteria and indicators presented in the work makes it possible to judge the synergetic efficiency level of management and the influence degree of certain synergy factors on the financial results of the enterprise. The methodology can be used by the management of enterprises in the development and substantiation of promising (medium-term) management decisions and programs for the development of enterprises.

5. Conclusion

The generalization of the studies' results previously presented in science by leading domestic and foreign scientists made it possible to clarify and systematize the main factors and conditions of synergy characteristic of industrial enterprises. All synergy factors can be divided into two groups - internal and external. Each of the synergy factors should be considered as a source of synergy and synergistic efficiency of enterprise management.

In this work, the authors propose a simplified formalized system of criteria and indicators for assessing the synergetic efficiency of managing a food industry enterprise using the example of beer production. The simplified indicators' system assumes that only one relative indicator is proposed for each synergy factor. At the same time, for each synergy factor considering the industry affiliation of the enterprise, a number of absolute and relative indicators can be proposed and substantiated, which should be brought to a comprehensive criterion for the corresponding synergy factor. It is also possible to further elaborate and expand the list of criteria for the synergetic efficiency of enterprise management.

In addition to the methodology development itself for assessing the synergistic efficiency of production and business management, it is also advisable to conduct research on the influence of technological production modes that retain their place in the sectoral economy on the factors and indicators of synergy and synergistic efficiency. This will make it possible to focus the attention of enterprise management on those factors' management and conditions that ensure the synergy of enterprises' activities within the technological structures to which they belong.

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