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# STRATEGIC PARAMETERS OF OPTIMAL PRODUCTION PLACEMENT

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**Purpose:** The article's main objective is to identify the systemic parameters of optimal production placement, which will allow making the right strategic decisions regarding the spatial development of economic activity.
**Design/methodology/approach**: The systemic approach became the basis for the research of the parameters of optimal production placement, which include the criterion for optimal placement, the number of places of optimal location and the optimal production volume in each optimal location, as well as the factors such as spatial differentiation of production costs, spatial differentiation of movement costs, and the economies of scale, which impact on the values of the optimal placement parameters.
**Findings:** The research identifies 24 scenarios that differ in the factors and the significance of their impact on the optimal placement parameters, as well as the significance of distance resistance. This categorization enables the distinction of nine groups of situations concerning the optimal placement of goods production. Such structuring improves the quality and simplifies the adoption of strategic decisions in the field of spatial business development.
**Originality/value:** The research in this article is the first to establish that the parameters of optimal production placement include the criterion and number of places of optimal location, as well as the optimal volume of production at those places. For the first time, it is proved that the optimal placement parameters depend on the spatial differentiation of production costs, the spatial differentiation of movement costs, and the economies of scale. The article addresses researchers studying the issues of strategic decision-making in the field of production placement.
**Keywords:** production placement, systemic approach, spatial cost differentiation, economies of scale, optimal placement parameters.
**Category of the paper:** Research paper.

## 1. Introduction

Research on issues related to improving the placement of goods production is important, as optimal production placement is a significant and sometimes even a decisive factor in its

efficiency. Therefore, production placement should not be carried out at random but should be based on thorough scientific justification. Such research will inevitably address the strategic parameters of optimal production placement (including the criterion for optimal placement, the number of places of optimal locations, and the optimal production volume at these locations), as well as the factors that shape these parameters' specific values.

The problem of the correct spatial economic organization, which to a greater or lesser extent raised the issues of the parameters of optimal production placement and the factors that impact on them, has been researched since the beginning of the development of economic science, but so far a systemic answer to these questions has not been formulated (Hale, Moberg, 2003; Farahani et al., 2010; Laporte et al., 2019). This applies to research on the optimal production placement of both material goods (Owen, Daskin, 1998; Bogataj et al., 2011; Ahmed et al., 2023) and services (Hernandez, Bennison, 2000; Chen, Tsai, 2016; Turkoglu, Genevois, 2020). Some researches focus on the factors of the placement of production goods (Mueller, Morgan, 1962; Falck, Heblich, 2008; Chatzoglou et al., 2018), and others focus on the reasons that act as barriers to placement (Newell et al., 2006; Bonfils et al., 2017; Cugno et al., 2021). Research on the issue of the parameters of optimal placement of goods production in countries with high production costs deserves attention (Ketokivi et al., 2017; Ancarani et al., 2019; Dachs et al., 2019). A whole area of research is focused on methods of justifying the optimal placement of objects in various fields (Hamacher, Nickel, 1998; Rousseau, Fried, 2001) with the hope of obtaining universal methods that can also be used to improve the spatial economic organization.

However, many important points related to the factors that impacted, impact, and will continue to impact the values of the optimal placement parameters have been ignored by scientists. This primarily concerns the criterion of optimal production location, which has never been considered systematically, but only in relation to a single specific site. A systemic approach was also lacking in terms of the number of optimal locations and the optimal scale of production, as the analysis was typically limited to one site and, accordingly, to the optimal production capacity at that site. This inherently gave the justification of production location and its strategic parameters a local rather than a universal character.

## 2. Situations for studying the parameters of optimal production placement

Historically, the issue of production placement arose simultaneously with production itself, when extremely strong distance resistance (DR) (the main characteristics of which are technical feasibility, cost, reliability and speed of cargo movement) made it impossible to significantly distance goods production away from the sales market. Under conditions of strong DR, the issue of optimal production placement did not exist in its "pure" form, as it "dissolved" into the issue of the location of settlements in general. However, to be fair, we should note the fact

that settlements often appeared in places of cheap goods production, in particular, food (the existence of cheap production is explained by the spatial differentiation of production costs (SDPC), which means that in different places of area the costs (unit and, accordingly, total) for the production of a given equal amount of the same goods will usually be different). In this situation, it was not demand that attracted production, but production that attracted demand; but the essence of the situation did not change - production and consumption of goods took place side by side.

Civilizational development is characterized by a steady decline in DR, which creates a potential opportunity to move production and goods consumption further away, which in the context of SDPC may be appropriate even if the costs of movement increase (movement costs in a broad sense include transportation and storage costs, as well as customs duties). The increase costs of movement here is an obvious consequence of the increase the distance to the sales markets and, accordingly, the spatial differentiation of movement costs (SDMC), which means that from different locations in area, the costs of movement a given equal amount of the same good to the same sales markets will tend to be different.

It is worth noting that the research of the parameters of optimal production placement should provide for a focus on a particular sales market option (in the case of strong DR, the sales market option was forced to be only one single sales market, and in the case of relatively weak DR, the sales market option may consist of more than one single sales market), which is necessary to determine the costs of goods production for a given capacity (equal to the demand of the sales market option) and the costs of movement the good from the potential place of the production to individual sales markets the appropriate sales market option. At the same time, production cost calculations should take into account the possibility of the existence of economies of scale (ES), which is the reduction of unit costs with increasing production volumes.

In the absence of ES, the orientation may be to a separate sales market each time, and if a location turns out to be optimal for production more than once, then this location may have one (with a capacity equal to the total demand of the individual sales markets for which this location turned out to be optimal) or more than one production facility (with a total capacity equal to the total demand of the individual sales markets for which this location turned out to be optimal). Under the impact of ES, it is necessary to study separately the options for orienting production to all options for the sales markets (both individual sales markets and their various combinations).

Table 1 describes the situations that capture the factors (individual and their various combinations) that impact on the parameters of the optimal placement of goods production: 1, 2, and 3 are situations of individual impact of factors (SDPC, SDMC, ES); 4, 5, and 6 are situations of joint impact of pairs of factors (SDPC and SDMC, SDPC and ES, SDMC and ES); 7 is the situation of joint impact of all three factors (SDPC, SDMC, and ES).

**Table 1.**
*Situations where factors impact on the parameters of optimal production placement*

| Characteristics of the impact | Factors | | |
|---|---|---|---|
| | SDPC | SDMC | ES |
| 1. Impact of SDPC only | + | - | - |
| 2. Impact of SDMC only | - | + | - |
| 3. Impact of ES only | - | - | + |
| 4. Joint impact of SDPC and SDMC | + | + | - |
| 5. Joint impact of SDPC and ES | + | - | + |
| 6. Joint impact of SDMC and ES | - | + | + |
| 7. Joint impact of SDPC, SDMC, and ES | + | + | + |

Source: own elaboration.

It is in the perspective of these situations, taking into account the significance of the DR, that it is advisable to analyze the issues of parameters of optimal placement of goods production (Table 2). At the same time, the extreme significance of the DR actually means that it is impossible to movement of good for technical reasons or that it is inexpedient to movement of good for economic reasons, significant means that the costs of movement of good to the market are comparable to the costs of production, and insignificant means that there is actually no time and money spent on movement of good to the market.

**Table 2.**
*Situations for studying the parameters of optimal production placement*

| Significance of factors and options for their impact | Significance of DR | | |
|---|---|---|---|
| | a) extreme significance | b) significant | c) insignificant |
| 1) Significant materiality of the factors | | | |
| 1. Impact of SDPC only | 1.1a | 1.1b | 1.1c |
| 2. Impact of SDMC only | 1.2a | 1.2b | 1.2c |
| 3. Impact of ES only | 1.3a | 1.3b | 1.3c |
| 4. Joint impact of SDPC and SDMC | 1.4a | 1.4b | 1.4c |
| 5. Joint impact of SDPC and ES | 1.5a | 1.5b | 1.5c |
| 6. Joint impact of SDMC and ES | 1.6a | 1.6b | 1.6c |
| 7. Joint impact of SDPC, SDMC, and ES | 1.7a | 1.7b | 1.7c |
| 2) Insignificance of the factors | 2a | 2b | 2c |

Source: own elaboration.

Let's first analyze the extreme positions on the significance of DR: the position of extreme significance of DR and the position of insignificance of DR. In the case of extremely significant DR with any significance (significant and insignificant) of the SDPC, SDMC, and ES, production should be located near the sales market (situations 1.1a-1.7a, 2a), since it is impossible to move the place of production away from the place of consumption. It should be noted here that although the criterion for optimal location in all these situations will be the same (near the sales market), there will be no such uniformity in the number of optimal locations and the optimal production capacity in those locations. Situations in which ES factor exists will differ in terms of the number of locations and production capacity in those locations from situations in which ES factor does not exist and thus does not affect the parameters of optimal production placement. For situations with the impact of ES factor, the criterion of optimal placement is near the sales market in one place with a capacity equal to the demand of the sales

market, and for situations without the impact of ES factor - near the sales market in an arbitrary number of places with a total capacity equal to the demand of this sales market.

Formerly, the extreme significance of DR applied to almost all goods and all regions (with a few exceptions, such as regions where waterways could be used for the movement of goods). In the course of civilization's development, there were fewer and fewer such goods and regions (but such goods and regions remained, and examples include mountainous regions or regions with insufficient infrastructure development, and goods that quickly lose quality, such as some confectionery), although new goods could sometimes be created that are problematic to movement (for example, the Moderna coronavirus vaccine, which requires extremely low temperatures).

Under conditions of insignificant (in fact, absent) DR, the situations regarding the optimal placement of goods production will be more diverse than under conditions of extremely significant DR. Let us briefly characterize it.

1) Situation 1.1c. (impact of SDPC only with insignificant DR). In the case of the impact of only the SDPC, the criterion for optimal location is the minimum production costs. If there is more than one location with minimum production costs, then the location will be possible in each of these locations, provided that the total production capacity in these locations with the same minimum production costs is equal to the demand of the respective individual sales market.
2) Situation 1.2c. (impact of only SDMC only with insignificant DR). In case of impacts of only SDMC, the criterion of optimal location is the minimum movement costs. In the actual absence of DR, there will be no movement costs and, accordingly, no SDMC, and the location can be free in any number of places, provided that the total production capacity in these places should be equal to the demand of the respective individual sales market.
3) Situation 1.3c. (impact of only ES only with insignificant DR). In the case of ES only, free location of production is allowed, but only in one location with a capacity equal to the demand of the respective individual sales market.
4) Situation 1.4c. (joint impact of SDPC and SDMC in case of insignificant DR). Because in case of the insignificant DR, the impact of SDMC can only be nominally discussed, then only the impact of SDPC remains. Accordingly, situation 1.4c. will not differ from situation 1.1c.
5) Situation 1.5c. (joint impact of SDPC and ES in case of insignificant DR). In the case of joint impact of SDPC and ES, the criterion of optimal location, as in situation 1.1.c., is the minimum production costs. However, a significant difference between situation 1.5c. and situation 1.1c. is that the location with a capacity equal to the demand of the relevant sales market option should be in only one location (even if there is more than one location with minimum production costs), while situation 1.1c. allows for more than one location with a respective dispersion of production volumes.

6) Situation 1.6c. (joint impact of SDMC and ES in case of insignificant DR). Because in case of the insignificant DR, the impact of SDMC can only be nominally discussed, then only the impact of ES remains. Accordingly, situation 1.6c. will not differ from situation 1.3c.
7) Situation 1.7c. (joint impact of SDPC, SDMC, and ES in case of insignificant DR). Because in case of the insignificant DR, the impact of SDMC can only be nominally discussed, then only the combined impact of SDPC and ES remains. Therefore, situation 1.7c. will not differ from situation 1.5c.
8) Situation 2c. (insignificant impact of SDPC, SDMC, and ES in case of insignificant DR) is identical to situation 1.2c.

Now let us analyze the most common impact of the factors of SDPC, SDMC, and ES in the time, industry, and spatial dimensions on the parameters of optimal production location in case of significant DR. Let us briefly characterize the situations that arise in this case regarding the optimal location of production.

1) Situation 1.1b (impact of SDPC only in case of significant DR). This situation is identical to situation 1.1c. both in terms of the optimal location criterion (minimum production costs) and the number of places for optimal location (within the number of places with the same minimum production costs) and production capacity in the places of optimal location (the total production capacity in these places will be equal to the demand of the respective individual sales market). It should be noted that the significance of DR, on which the value of the movement costs depends, does not affect these optimal location parameters, since the impact depends not on the absolute value of the movement costs (which will be higher in situation 1.1b), but on SDMC (which is absent in these two situations - 1.1b and 1.1c).
2) Situation 1.2b (impact of SDMC only in case of significant DR). In case of the impact only of SDMC:
   – the criterion for optimal location is the minimum cost of movement,
   – the number of places for optimal location is no more than the number of places with the same minimum amount of movement costs,
   – the total production capacity at the places of optimal location is equal to the demand of the respective individual sales market.
3) Situation 1.3b (impact of ES only in case of significant DR). This situation is identical to situation 1.3c. both in terms of the optimal location criterion (free location of production), and in terms of the number of places for optimal location (any location, but only one), and production capacity at the places of optimal location (equal to the demand of the relevant sales market option). As in situation 1.1b, the significance of DR does not affect on these optimal location parameters, since the impact depends not on the absolute value of the movement costs (which will be higher in situation 1.3b), but on SDMC (which is absent in these two situations - 1.3b and 1.3c).

4) Situation 1.4b (joint impact of SDPC and SDMC in case of significant DR). The criterion of optimal location for each individual sales market is the minimum total costs of production and movement of goods from the potential place of production to the respective individual sales market. If it turns out that there is more than one place with the minimum total of production and movement costs for an individual sales market, then production may be located in any number of such places with a total capacity equal to the demand of that individual sales market.
5) Situation 1.5b (joint impact of SDPC and ES in case of significant DR). In the case of joint impact of SDPC and ES, the criterion for optimal location (as in situation 1.1.b) is the minimum production costs. However, a significant difference between situation 1.5b and situation 1.1b is that the location with the appropriate capacity (equal to the demand of the respective option of the sales market) should be located in only one place (even if there is more than one place with minimum production costs), while situation 1.1b allows for location in more than one place with appropriate dispersion of production volumes. In other words, situation 1.5b is identical to situation 1.5c, although in the first case there is significant DR, and in the second case DR is not significant. Recall that the effect of the level of significance of DR on the optimal location does not depend on the absolute value of the movement costs (which will be higher in situation 1.5b), but on SDMC (which is absent in these two situations - 1.5b and 1.5c).
6) Situation 1.6b (joint impact of SDMC and ES in case of significant DR). The criterion of optimal location is the minimum total costs of production and movement of goods to the sales markets (a systemic approach to justify in which places to produce how much). Although in this situation there is no impact of SDPC, which seems to make it unnecessary to take into account production costs, the existence of ES makes it necessary to take production costs into account in the optimal location criterion. Since ES in the absence of SDPC does not depend on place, its impact reinforces the advantage of places with lower costs of goods movement to the respective sales markets.
7) Situation 1.7b (joint impact of SDPC, SDMC, and ES in case of significant DR). The criterion of optimal location is the minimum total costs of production and movement of goods to the sales markets (a systemic approach to justify in which places to produce how much). Although situation 1.7b largely coincides with situation 1.6b, but the presence of SDPC factor makes it likely that the result will change, since the ES may depend on the place.
8) Situation 2b (insignificant impact of SDPC, SDMC, and ES in case of significant DR). The situation seems to be identical to situation 2c: location can be free in any number of places with any capacity, provided that the total production capacity in these places should be equal to the total demand of the sales markets, but adds a bit of pressure the significant DR, which provokes the expediency of location near the sales markets.

However, it should be emphasized here that minimizing the costs for moving goods to the sales markets is not necessarily related to production location near the sales markets. First, shorter movement distances do not necessarily guarantee lower transportation costs, as places (e.g., transportation hubs) that are farther away from the sales markets may have a broader range of transportation options, allowing for more efficient transportation of the good to the sales markets than transportation of the same good from places that are located relatively close to the sales markets. Secondly, a closer location to the sales market does not guarantee savings (compared to a farther location) even in terms of customs duties. A classic example in this situation is the USA border locations in Mexico (very close to the sales market in San Diego, California) and locations in Hawaii (very far from San Diego). When goods are produced near Mexico for the San Diego sales market, import duties will have to be paid, but when goods are produced in Hawaii for the same sales market, no duties will have to be paid. Therefore, situation 2b will indeed be identical to situation 2c.

## 3. Groups of situations regarding the optimal placement of goods production

The matrix of parameters of the optimal placement of goods production according to the analyzed situations is summarized in Table 3. As can be seen from the matrix in Table 3, the parameters of many situations are the same (situations with the same parameters are highlighted): 1.1a, 1.2a, 1.4a, 2a (group 1), 1.3a, 1.5a, 1.6a, 1.7a (group 2), 1.1b, 1.1c, 1.4c (group 3), 1.5b, 1.5c, 1.7c (group 4), 1.3b, 1.3c, 1.6c (group 5), 1.2c, 2b, 2c (group 6), 1.6b, 1.7b (group 7). And only situations 1.2b and 1.4b are single entities within their groups (group 8 and group 9, respectively).

**Table 3.**
*Matrix of parameters of the optimal placement of goods production*

| **Significance of the factors** | **Significance of DR** | | |
|---|---|---|---|
| | **a) Extreme significance** | **b) Significant** | **c) Insignificant** |
| 1) Significant | | | |
| 1. Impact of SDPC only | 1.1a. Near the sales market (in any number of places with a total capacity equal to the demand of this sales market) | 1.1b. Minimum production costs (in places of minimum production costs with total capacity equal to the demand of the respective individual sales market) | 1.1c. Minimum production costs (in places of minimum production costs with total capacity equal to the demand of the respective individual sales market) |
| 2. Impact of SDMC only | 1.2a. Near the sales market (in any number of places with a total capacity equal to the demand of this sales market) | 1.2b. Minimum movement costs (in places of minimum movement costs with a total capacity equal to the demand of the respective individual sales market) | 1.2c. Free placement of production (in any number of places with a total capacity equal to the demand of the respective individual sales market) |

Cont. table 3.

| | | | |
|---|---|---|---|
| 3. Impact of ES only | 1.3a. Near the sales market (in one place with capacity equal to the demand of this sales market) | 1.3b. Free placement of production (in one place with capacity equal to the demand of the respective sales market option) | 1.3c. Free placement of production (in one place with capacity equal to the demand of the respective sales market option) |
| 4. Joint impact of SDPC and SDMC | 1.4a. Near the sales market (in any number of places with a total capacity equal to the demand of this sales market) | 1.4b. Minimum total costs of production and movement of the good to the respective individual sales market (in places of minimum total costs of production and movement with total capacity equal to the demand of this sales market) | 1.4c. Minimum production costs (in places of minimum production costs with total capacity equal to the demand of the respective individual sales market) |
| 5. Joint impact of SDPC and ES | 1.5a. Near the sales market (in one place with a capacity equal to the demand of this sales market) | 1.5b. Minimum production costs (in one place with a capacity equal to the demand of the respective individual sales market option) | 1.5c. Minimum production costs (in one place with a capacity equal to the demand of the respective individual sales market option) |
| 6. Joint impact of SDMC and ES | 1.6a. Near the sales market (in one place with a capacity equal to the demand of this sales market) | 1.6b. Minimum systemic total costs of production and movement of the good to sales markets (in systemically optimal places with capacity equal to the demand of the respective sales market option) | 1.6c. Free placement of production (in one place with capacity equal to the demand of the respective sales market option) |
| 7. Joint impact of SDPC, SDMC, and ES | 1.7a. Near the sales market (in one place with a capacity equal to the demand of this sales market) | 1.7b. Minimum systemic total costs of production and movement of the good to sales markets (in systemically optimal places with capacity equal to the demand of the respective sales market option) | 1.7c. Minimum production costs (in one place with a capacity equal to the demand of the respective individual sales market option) |
| 2) Insignificant | 2a. Near the sales market (in any number of places with total capacity equal to the demand of this sales market) | 2b. Free placement of production (in any number of places with a total capacity equal to the demand of the respective individual sales market) | 2c. Free placement of production (in any number of places with a total capacity equal to the demand of the respective individual sales market) |

Source: own elaboration.

Groups of situations regarding the optimal placement of goods production are shown in Table 4.

**Table 4.**
*Groups of situations regarding the optimal placement of goods production*

| Group number | Parameters of optimal placement of goods production in a group | Situation code |
|---|---|---|
| 1 | Placement near the sales market (in any number of places with a total capacity equal to the demand of this sales market) | 1.1a, 1.2a, 1.4a, 2a |
| 2 | Placement near the sales market (in one place with a capacity equal to the demand of this sales market) | 1.3a, 1.5a, 1.6a, 1.7a |
| 3 | Placement in places of minimum production costs with total capacity equal to the demand of the respective individual sales market | 1.1b, 1.1c, 1.4c |

Cont. table 4.

| | | |
|---|---|---|
| 4 | Placement in one place with a minimum production cost with a capacity equal to the demand of the respective individual sales market option | 1.5b, 1.5c, 1.7c |
| 5 | Free placement of production in one place with capacity equal to the demand of the respective sales market option | 1.3b, 1.3c, 1.6c |
| 6 | Free placement of production in any number of places with a total capacity equal to the demand of the respective individual sales market | 1.2c, 2b, 2c |
| 7 | Placement in the places of minimum systemic total costs of production and movement of the good to sales markets with capacity equal to the demand of the respective sales market option | 1.6b, 1.7b |
| 8 | Placement in places of minimum movement costs with a total capacity equal to the demand of the respective individual sales market | 1.2b |
| 9 | Placement in places of minimum total costs of production and movement of the good to the respective individual sales market with total capacity equal to the demand of this individual sales market | 1.4b |

Source: own elaboration.

Of the groups of situations mentioned in Table 4, in the vast majority of cases, there will be no problems in justifying the optimal location. In Groups 1 and 2, it is enough to identify sales markets and locate near them with the right production capacity. In Groups 3 and 4, it is enough to identify the places of minimum production costs and locate there with the right production capacity.

In Groups 5 and 6, location is free, but care should be taken to determine the number of places and the production capacity of each location. By the way, since in groups 5 and 6 the production of goods can be located anywhere, government authorities (at the local, regional, and national levels), as well as relevant place marketing organizations, should concentrate their efforts on attracting the respective investors. These investors will be the most susceptible to the effects of place marketing, which involves marketing incentives for production location.

In Group 8, it is enough to identify locations with the lowest movement cost to an individual sales market and to locate there with a total capacity equal to the demand of that sales market. In group 9, it is enough to identify places with the minimum amount of production and transportation costs when targeting an individual sales market and to locate there with a total capacity equal to the demand of this sales market.

Only group 7 requires a rather complex justification of the optimal locations and production capacity in these locations (systemic approach). This involves a two-stage justification of the optimal location of production, the theoretical justification and methodology of which are described in detail in our previous publications (Stadnicki, Terebukh, 2022; Stadnicki, Bashynska, 2023). In this article, we briefly emphasize the essence of each of these two stages.

## 4. Two-stage justification of the optimal location of production

At the first stage, for each variant of the sales market (it should be reminded that a variant of the sales market is an individual market or their various combinations), according to the criterion of minimum total costs of production of a good in the amount of demand of the respective variant of the sales market and the movement of this good from the potential place of production to individual sales markets (which shape this variant of sales market) in the amount of demand of each of them, the locally optimal place of production is justified. Obviously, at this stage, the planned total production capacity in locally optimal places will significantly exceed the total demand of individual sales markets, but we emphasize that this is only the first stage of a systemic justification process that allows for the formation of competing options for the parameters of optimal location of goods production.

At the second stage, the locally optimal locations of good production identified in the first stage are used to form sets of competing locations that will form potentially systemically optimal locations. At the same time, the locally optimal place, whose selection is based on the orientation of production toward a sales market option that integrates all individual markets, is also one of the potential systemically optimal placement options. All other potential systemically optimal location options are a combination of locally optimal places that ensure production volume equal to the total demand of all individual sales markets. The criterion of a systemically optimal location option is the minimum total cost of goods production in the amount of demand of the entire market (in one place or more than one place) and of transporting this good from the place or places of production to all individual sales markets in the amount of their demand.

It should be emphasized that group 7 covers the most common situations regarding the optimal location of goods production, and at present, the share of these situations is probably at least 90% of the total number of situations in this area.

And two more important points that we consider it appropriate to briefly note in this article, but which deserve a separate, and detailed research in the future. The first point concerns area of possible placement (this is area within which the optimal placement of the production of the respective good is justified on a mandatory or voluntary basis), which may depend on many factors and take on meanings ranging from global (the entire planet Earth and even the near space) to local (for example, a basic-level administrative-territorial unit or even a part of it). The second point relates to special places within the area of possible placement, which are attractive places of production characterized by the presence of factors for the placement of production of the respective good.

Justification of optimal placement of goods production with area of possible placement will not necessarily lead to a different result than such a justification without spatial restrictions, but in general, the spatial restrictions "within area of possible placement" may lead to a different

result in terms of optimal locations places and production volume at these places. Therefore, in all situations from Tables 3 and 4 regarding the optimal placement of goods production (only except situations 1.1a-1.7a and 2a, which are related to the extraordinary impact of DR), the wording of the criteria for the optimal placement of goods production should be supplemented with the following ending "within area of possible placement".

Let us now discuss attractive places of production. For various reasons (primarily, to increase various types of security - military, environmental, economic, etc.), attractive places for production may have certain restrictions on the volume of goods production, which may affect the optimal placement of goods production. During the formulation of optimal placement parameters, this should be taken into account by adding the phrase "taking into account the restrictions of attractive places for production on the volume of goods production" at the end of the description of the parameters of optimal placement of goods production in the group from Tables 3 and 4.

## 5. Conclusions

1. The placement of goods production should not be done at random but requires a thorough scientific justification. Such research will inevitably concern the parameters of optimal production placement (such as the optimal placement criterion, the number of places of optimal locations, and the optimal production volume at each place of optimal location), as well as the factors (spatial differentiation of production costs, spatial differentiation of movement costs, and economies of scale) that will affect the values of the optimal placement parameters.
2. The research on the problem of optimal placement of goods production includes 24 positions, which differ in the factors and the significance of their impact on the parameters of optimal placement, as well as the significance of distance resistance. Each position is characterized by the following parameters: production placement criterion; number of places of production; and production capacity at each place.
3. The analysis of the obtained results allows us to distinguish 9 groups of situations regarding the optimal placement of goods production. The most complex (but also the most common) for justifying the optimal placement is group of situations No. 7 (includes 2 items - 1.6b and 1.7b), where a systemic two-stage approach is assumed, and the criterion for optimal production placement is the minimum of systemic total costs of production and movement of goods to sales markets.
4. In all situations regarding the optimal placement of goods production, must be taken into account the agreed decision on area of possible placement and possible restrictions on the volume of goods production in attractive places.

The classification model proposed in this study contributes to existing approaches by offering a systemic and multidimensional framework that incorporates both cost-related and spatial factors in a structured typology of 24 scenarios. Unlike earlier models that often emphasize only economic or spatial parameters separately, our model integrates these dimensions and provides a clearer analytical basis for identifying optimal production locations under realistic constraints. This comprehensive classification supports more informed and context-sensitive decision-making in production planning.

Regarding directions for further research in the field of parameters of optimal placement of goods production. At first, it is interesting and necessary to research the sectoral aspects in this area, which is to identify which parameters are characteristic of different sectors of the economy. Secondly, the research of regional aspects of the parameters of optimal placement of goods production also deserves attention. Thirdly, the research into time-related aspects, which means identifying past, present, and forecasting future parameters of the optimal placement of goods production, will not only organize the necessary information but also develop options for the future based on historical trends. Issues related to the area of possible placement and the restrictions on the volume of goods production in attractive places for production also require in-depth research when justifying the parameters of optimal placement of goods production. It is also evident that future research should have an applied focus, which implies empirical testing of the theoretical propositions in order to establish a clearer distinction between theoretical abstractions and practical applications.

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