PRODUCTION OF GOODS: WHAT, WHERE, HOW, HOW MUCH AND FOR WHOM

Jerzy STADNICKI[1*], Yuliia BASHYNSKA[2]

[1] University of Technology, Kielce; yurijs@tu.kielce.pl, ORCID: 0000-0001-7760-1347
[2] State Institution «Institute of regional research named after M.I. Dolishniy» of the National Academy of Sciences of Ukraine; yu.bashynska@ukr.net, ORCID: 0000-0002-2457-4135
* Correspondence author

Purpose: Publications on the issues of justification for the selection of optimal production solutions are extremely numerous, but all of them have not been comprehensive, as they have studied in isolation different aspects of this, in fact, holistic problem. Therefore, the purpose of the article was to develop a systematic approach to justifying the choice of what to produce, where to produce, how to produce, how much to produce and for whom to produce.

Design/methodology/approach: Morphological analysis is used as the main research method.

Findings: The paper proves that the justification of "what, where, how, how much and for whom" to produce should be carried out comprehensively, interdependently and mutually coordinated, since all these 5 parameters are optimized together within the limits of one task. The proposed sequence of actions will provide a systematic approach to justifying the choice of what to produce, where to produce, how to produce, how much to produce and for whom to produce.

Research limitations/implications: In the further study of "what, where, how, how much and for whom" to produce, it is advisable to focus on the problems of the production range in the direction of the "set of goods", which should be produced in the appropriate places using the appropriate technologies, in the appropriate volumes, and for the appropriate sales markets.

Practical implications: The use of research results in practice will improve the quality of substantiating the choice of optimal production solutions (what, where, how, how much and for whom to produce). This will have a positive impact on business development.

Social implications: The results of the study can be used to improve state policy in the areas of spatial organization of the economy and technological development of the economy, which will have a positive effect on the quality of life of a society.

Originality/value: The value of the article lies in the development of a systematic approach to justifying the choice of what to produce (which goods), where to produce (which location), how to produce (with the help of which technologies in each place), how much to produce (in what volume in each place), for whom to produce (for which markets in each location). The article is addressed to entrepreneurs, scientists who deal with the issue of justifying the choice of optimal solutions for the production of goods, as well as state institutions in the field of economic development.

1. Introduction

Business efficiency is determined by making the right decisions about what to produce (what goods), where to produce (locations), how to produce (with the help of which technologies), how much to produce (volume), for whom to produce (to which sales markets). Therefore, improving the rationale for choosing optimal production solutions has always been, is, and will always be an important scientific and practical task.

There are many interesting studies that offer economic justification methods for "what to produce?" (Alvarez, 2007; Fauziah, 2022; Graaf, 2020; Hjorth, 2015; Kier, 2018; Korsgaard, 2016; Leatherbee, 2020; Ott, 2017; Priem, 2018; Safitri, 2023; Squadrito, 2023). There are also plenty of highly professional studies on the economic rationale of "where to produce?" (Branco, 2019; Brown, 1979; Fujita, 2004; Krugman, 2010; Moses, 1958; Stadnicki, 2022; Venables, 1996). There is an extremely large amount of research on the economic justification of "how to produce?" (Andersen, 2018; Azzone, 1989; Beaves, 1988; Borgonovo, 2004; Dobrowolski, 2022; Fuss, 2008; Magni, 2010, 2023; Park, 2004; Proctor, 1992; Shank, 1996; Solow, 1957; Vlachý, 2017; Wiendahl, 2004). A whole layer of research is devoted to the problem of "how much to produce?" (Bueno, 2020; Cantamessa, 2000; Correia, 2021; Goswami, 2023; Ho, 2013; Mariel, 2015; Negahban, 2018). And research of the topic "for whom to produce?" can be found in many scientific papers that are devoted not only to economics and management, but also to marketing and logistics (Bernard, 2019; Daudin, 2011; Heijden, 2013; Li, 2022; Paul, 2020). Publications on the issues of justification for the selection of optimal production solutions are extremely numerous, but all of them are not comprehensive, as they consider different aspects of this influential problem separately. It is obvious that even in a study that is not complex, it is possible to obtain individual positive results (local optima), but a non-comprehensive study has no chance of a system optimum.

2. A systematic approach to justifying "what, where, how, how much and for whom" to produce

A comprehensive study of the integral problem of "what, where, how, how much and for whom" to produce is quite logical to begin with the answer to the question "what to produce?" However, at this initial stage, this answer will only be a declaration of intent, since the final answer whether this "what" is planned to be produced is really worth producing must be based on the answers to the other components of the investigated holistic problem: "where, how, how much and for whom" to produce.

The justification of "what, where, how, how much and for whom" to produce must be carried out interdependently in a harmonious sequence that will ensure obtaining a high-quality result. The proposed sequence of actions for substantiating "what, where, how, how much and for whom" to produce is given in the table 1.

Table 1.
The sequence of justification "what, where, how, how much and for whom" to produce

No.	Action content
1.	What is planned to be produced is determined (declaration of intentions)
2.	Outline of the space of possible placement of production
3.	Outline of potential sales markets and assessment of the demand for each of them
4.	Options for sales markets are formed from the potential sales markets, and calculation of the demand for each of them
5.	A list of production technologies is formed
6.	The factors of production location are identified
7.	Attractive places of production are identified within the space of possible placement
8.	The locally optimal production technologies are substantiated for each attractive place of production, while focusing on the appropriate options for sales markets
9.	A list of transportation technologies between each attractive place of production and all potential sales markets of the corresponding sales market option is formed
10.	Locally optimal transportation technologies between each attractive place of production and all potential sales markets of the corresponding sales market option are substantiated
11.	The locally optimal place of production and locally optimal production and transportation technologies from the set of its attractive production locations are determined for each option of the sales market
12.	Variants of potential systemically optimal places with potentially systemically optimal production and transportation technologies are formed from locally optimal places
13.	The choice of the best one, that is, the option of systemically optimal places with systemically optimal production and transportation technologies from the options of potential systemically optimal places is justified
14.	The expediency of implementing the optimal option "what, where, how, how much and for whom" to produce is evaluated.

Source: Author's development.

Further the positions of the given list of actions is described.

  1. What is planned to be produced is determined (declaration of intentions). On this stage a specific good or a certain set of goods is meant. It is this initial action that is absolutely necessary, since all subsequent actions depend on it. In the end, as a result of the justifications, it may turn out that the declaration of intentions will remain only a declaration, since the justification will show the impracticality of the

planned production, but the declaration of intentions, which specific good or set of goods is planned to be produced, is a mandatory stage of the start of the procedure. If, indeed, the initial declaration of intentions remains only a declaration, then a new justification procedure will have to be started, again, with the formulation of some new declaration of intentions, which good or set of goods is planned to be produced.

2. *Outline of the space of possible location of production*. Here, to some extent, the answer to the question "where to produce?" is being formed, but at a fairly general level, since it is a relatively large space, within which there may be hundreds of specific places, among which it will be necessary to justify the choice of optimal ones. It can be a space from the global (the entire planet Earth and the outer space) to the local (for example, an administrative-territorial unit of the basic level or even its part). Choosing a global space of possible locations ensures that optimal locations do not lie outside of it, but such a choice will require a lot of calculations for a huge number of attractive production locations (production costs for different capacity options, transportation costs to various potential sales markets). Therefore, in a situation where the rejection of the global space of possible placement does not pose a threat to the correctness of the choice of optimal production locations, it is advisable to limit the space of possible placement taking into account the relevant factors: the properties of the "production" side (where aspects related to: what is produced are taken into account; production technology; necessary resources for production; pollution generated during production), and the properties of the "place" side (where various aspects related to the properties of the corresponding space are taken into account, in particular, legal, geographical, infrastructural, etc.).

3. *Outline of the potential sales markets and assessment of the demand for each of them*. Here, to some extent, answers to the question "for whom to produce?" and "how much to produce?", but at a fairly general level, since it is about the demand of individual markets and the general demand without reference to places of production. Orientation when justifying the optimal placement of production on potential sales markets is necessary, both from the point of view of taking into account the costs of transportation from the place of production to the places of consumption, and from the point of view of production capacity, since unit and total production costs depend on it. Taking into account the transportability of the good that is planned to be produced, it is expedient to aggregate potential sales markets: as transportability increases, the space for aggregating demand increases. Potential sales markets should be delineated taking into account the space of possible placement, which will allow identification of places that will require customs payments when exporting goods produced there, or places in the territory of states that are under various sanctions. The demand of each potential market has to be estimated using known methods.

4. *Sales market options are formed from the potential sales markets, demand for each of them is calculated.* Answers to the question "for whom to produce?" are also formed here and "how much to produce?", but already at a more specific level, since sales market options are separate potential sales markets and their combinations. Sales market options are formed and characterized by potential sales markets that are a part of these sales market options. The parameters of the sales market option are described by the coordinates of potential sales markets and demand (individual of each potential sales market and the total of all potential sales markets of the corresponding sales market option). It is obvious that individual potential sales markets can be part of several sales market options. The demand of the sales market option is defined as the sum of the demand of the potential sales markets included in its composition. It is the options of the sales market that will act as "units of demand", the orientation of which, when placing production, will determine the potential production capacity (and, accordingly, the unit and total costs of production), as well as the directions and volume of transportation (and, accordingly, the unit and total costs of transportation). Limiting the orientation when justifying the optimal location of production only by some individual option of the sales market (regardless of whether it will be formed from one or several potential sales markets) is erroneous, as it is not systematic and does not take into account competitive options. If there are even only two potential sales markets, three sales market options are possible: sales market option #1 is only potential sales market #1, sales market option #2 is only potential sales market #2, sales market option #3 is both potential sales market #1 and potential sales market #2. It is obvious that the increase in the number of potential sales markets leads to a significant increase in the number of sales market options. For each orientation, when placing production on the sales market option, the locally optimal location may be different.

5. *A list of production technologies is formed.* As a rule, a good can be produced by several interchangeable technologies: for example, production of paper from business wood and waste paper, production of gasoline from oil or coal, production of electricity at thermal power plants, nuclear power plants, hydroelectric power plants, etc. Forming a list of production technologies is a preparation for answering the question "how to produce?". In the future, the optimal production technologies will be selected from the created list. At the same time, various options for choosing optimal technologies from the list of potentially possible options will be possible: from one identical optimal technology to many different optimal technologies for each optimal place of production.

6. *Identification of the factors of production location*. Location drivers are reasons to consider when justifying or predicting future location (answering the question "where?") or explaining past or existing location (answering the question "why here?"). Production location factors are part of the properties of the following components of the "production" side: production technologies; resources that are necessary for production using the appropriate technology; negative effects on the environment (mainly pollution) that occur in the production process when applying the appropriate technology; of what is planned to be produced. Production location factors can be specific for each production technology, which can obviously lead to an increase in the number of attractive production locations, since there will be a change in three of the four components of "production" (technology, resources, negative impacts on the environment) and a corresponding change in production location factors, which will be able to cause a shift to more attractive places of production. Identification of factors of production location is a preparation for answering the question "where to produce?", because production will be in the optimal places where the relevant factors of production location will have the greatest impact.

7. *Attractive places of production are identified within the space of possible placement*. At the same time, there may be many options. One of them is that each orientation to the market option may have its own attractive places of production, because it is one thing to produce in a small volume for the market option with low demand (small producers have a lot of attractive places of production, since their requirements for various resources are limited), and another matter is powerful production, which will have significantly fewer attractive places of production.

    Not every attractive production location within the space of possible placement needs to be considered an attractive production location for every market option. Some attractive places of production within the space of possible placement may not be suitable according to the criterion of the volume of production (taking into account environmental restrictions, the volume of resource requirements) for the placement of a powerful production, i.e. one that is oriented to the option of a sales market with significant demand. It is clear that the focus on the option of the sales market with significant demand, which means a significant production capacity, will lead to a significantly smaller number of attractive places of production than the orientation on the option of the sales market with a small demand. This is because the small volume of production has smaller demands on various resources and has relatively less environmental restrictions.

8. *The locally optimal production technology is substantiated for each attractive place of production while orienting the location to the appropriate sales market options*. The locally optimal production technology is substantiated taking into account the previously formed list of production technologies. This is an important stage of

forming the answer to the question "how to produce?", since locally optimal production technologies and systemically optimal production technologies will be selected in the future. The substantiation of locally optimal production technologies is carried out with reference to the corresponding options of the sales market (to take into account the production capacity, which is assumed to be equal to the demand of the option of the sales market, on which unit and total costs depend) according to the criterion of minimum production costs. At the initial stage, production costs are calculated for each attractive production location in relation to the corresponding sales market option and the locally optimal production technology is substantiated. Since an attractive place of production can focus on several market options, the number of locally optimal production technologies in each attractive place of production will correspond to the number of market options. That is, the locally optimal production technology in an attractive place of production needs to be substantiated only for admissible variants of binding to the variant of the sales market. It should be emphasized that different production technologies may be optimal in different attractive production locations of each sales market option, and that, again, different technologies may be optimal in one and the same attractive production location when targeting different sales market options production.

9. *A list of transportation technologies between each attractive place of production and all potential sales markets of the corresponding sales market option is formed.* It should be emphasized that the transportation technology will be characterized by the transportation route, the type of transportation, and the volume of transportation. At the same time, it is necessary to take into account the possibility of transporting several or all portions of cargo on one flight (let's call it group transportation). This means that it is necessary to take into account not only the possibility of individual transportation between each attractive place of production and each potential sales market of the corresponding sales market option, but to implement a systematic approach, providing for the possibility of transporting several or all portions of cargo in one flight, if the number of potential sales markets in corresponding to the sales market variant exceeds one. Accordingly, each option of transportation between an attractive place of production and potential sales markets of the corresponding option of the sales market of the entire volume of production (which is equal to the demand of the option of the sales market) should be considered as a separate technology. Therefore, the following options will be separate technologies of transportation:

   a) an option that involves combining all only individual transportations between each attractive place of production and each potential sales market of the corresponding sales market option,

b) an option that provides for transportation on one flight between each attractive place of production and all potential sales markets of the corresponding sales market option,

c) options that provide for the combination of separate individual transportations between an attractive place of production and separate potential sales markets of the corresponding sales market option and group transportations so that the demand of all potential sales markets of this sales market option is satisfied.

Forming a list of transportation technologies is a preparation for the answer to the question "how to produce?", although with the help of the answer to the question "how to transport?", since when justifying locally optimal production technologies and systemically optimal production technologies, the costs of transporting the produced goods to sales markets are taken into account. In the future, the optimal transportation technologies will be selected from the created list.

10. *Locally optimal transportation technologies between each attractive place of production and all potential sales markets of the corresponding sales market option are substantiated.* Locally optimal transportation technologies are substantiated taking into account the previously formed list of transportation technologies. This is an important stage of forming the answer to the question "how to produce?", although with the help of the answer to the question "how to transport?", since when justifying the locally optimal production technology and systemically optimal production technology, the costs of the locally optimal technology of transporting the produced good to the sales markets are taken into account. The selection of the locally optimal transportation technology will be carried out according to the criterion of minimum transportation costs between an attractive place of production and potential sales markets of the corresponding sales market option in the amount of demand of each of these potential sales markets (the total demand for potential sales markets forms the demand for the corresponding sales market option). At the initial stage, the choice of the locally optimal transportation technology between each attractive place of production and potential sales markets of the corresponding sales market option is substantiated. It has to be noted that the binding to the sales market option affects the amount of transportation costs. Since an attractive production location can target all market options, the number of locally optimal transportation technologies in each attractive production location will correspond to the number of market options. If necessary, a locally optimal transportation technology in an attractive place of production can be justified not for all, but only for a part of the sales market options. If the fact, that different production technologies can be optimal for different attractive production locations of each sales market option, as well as the fact that different production technologies can also be optimal in one and the same attractive production location when targeting different sales market options. Also, the difference in optimal

transportation technologies between one and the same attractive place of production and potential sales markets of different sales market options is obvious.

11. *For each variant of the sales market, the locally optimal place of production and locally optimal production and transportation technologies from the set of its attractive production locations is determined.* At this stage, there is an approach to the final answer to the question - "where to produce?" and "how to produce?", because systemically optimal places will be identified among locally optimal places in the future, and systemically optimal technologies among locally optimal technologies. It should be emphasized here once again that when justifying the locally optimal production location for the sales market option, only attractive production locations that will be identified as attractive production locations for the corresponding sales market option can be taken into account. Among these attractive production locations of each market option, locally optimal locations will be selected by comparing their locally optimal technologies (production and transportation) according to an indicator that will take into account the total production costs in the demand volume of the market option and transportation costs between the attractive production location and potential markets sales of the corresponding variant of the sales market (in the amount of demand of the corresponding potential sales markets).

As a result of such a comparison, the locally optimal technologies (production and transportation) of an attractive place of production with a minimum indicator of total costs are identified as locally optimal technologies when focusing on the appropriate sales market option, and the corresponding attractive place of production is identified as a locally optimal place of production when focusing on this sales market option. Each locally optimal place will be characterized by locally optimal technologies (production and transportation), as well as production capacity, which will be equal to the demand of the corresponding sales market option (that is, the production capacity at this stage is actually set by the demand of the sales market option). The result of the substantiation of optimal production and transportation technologies for individual options of the sales market will be a set of locally optimal technologies and locally optimal locations (each option of the sales market will have its own locally optimal location, although one location can be a locally optimal location for several options of the sales market) with production capacities, equal to the demand of the corresponding sales market options.

12. *The variants of potential systemically optimal places with potentially systemically optimal production and transportation technologies are formed from locally optimal places.* The formation of potential systemically optimal places with potentially systemically optimal technologies is the completion of preparation for the answer to the question "where to produce?" and "how to produce?", since systemically optimal places and systemically optimal technologies will be chosen precisely among potential

systemically optimal places with potentially systemically optimal technologies. The variant of the set of locally optimal locations, in which the total volume of production is equal to the total aggregate demand of all potential sales markets, is one of the variants of potential systemically optimal locations. With the system approach, variants of sets of locally optimal locations, the total production capacity of which is equal to the general (system) demand, will be compared. At the same time, the following options are possible:

a) an option that involves only one place of production in the amount of the total demand of all potential sales markets,

b) the option, which provides that the number of production sites will be equal to the number of potential sales markets, and the volume of production in each such site will correspond to the demand for potential sales markets on which the placement of the corresponding production was oriented (that is, for each potential sales market, production will be carried out by a separate manufacturer),

c) options that provide for the combination of individual manufacturers in the number of two to the number provided for by option (b) minus 1. It is clear that option (c) makes sense only when the number of potential sales markets is more than 1.

Each option of potential systemically optimal locations will be characterized by its set of potentially systemically optimal production and transportation technologies: these will be locally optimal technologies of locally optimal locations that form the corresponding option of potential systemically optimal locations.

13. *From the options of potential systemically optimal places, we justify the choice of the best one, that is, the option of systemically optimal places with systemically optimal production and transportation technologies.* This is the final stage of forming an answer to the question "where, how, how much and for whom to produce?". The variant of the set of locally optimal locations with the minimum total costs will be optimal and the locally optimal locations of this variant are identified as systemically optimal locations, in which it is necessary to locate production with the corresponding technologies, which are identified as systemically optimal technologies, and with the corresponding capacities, which are identified as systemically optimal capacities . That is, at this stage, competition will take place between locally optimal places with their corresponding locally optimal technologies, but the technologies of locally optimal places will not compete with each other directly, since their choice is determined by orientation to different options of the sales market. Variants of sets of locally optimal places (potential systemically optimal places) and production and transportation technologies corresponding to them will compete. Since each variant of the set of locally optimal places can have different production and transportation technologies, it is difficult to assess which of them ensured victory in the competition

of variants of sets of locally optimal places and the transformation of one of them (which will turn out to be optimal) into systemically optimal places.

The result of solving the problem will be information about 5 parameters of production and transportation - "where to produce?" (attractive production locations identified as systemically optimal locations) within the space of possible placement, "how to produce?" (systemically optimal production technologies in systemically optimal locations), "how much to produce?" (production capacity at each systemically optimal location), "for whom to produce?" (potential sales markets and the sales market options formed by them for each systemically optimal location), "how to transport?" (systemically optimal transportation technologies between systemically optimal locations and corresponding potential sales markets). That is, the result is a justification for choosing systemically optimal:

- places of production (from many attractive places of production),
- production technologies in each systematically optimal place of production,
- production capacities in each systematically optimal place of production,
- transportation technologies between each systemically optimal place of production and corresponding potential sales markets,
- sales markets (from a set of potential sales markets) for each systematically optimal place of production.

14. *The evaluation of the expediency of implementing the optimal option "what, where, how, how much and for whom" to produce.* The option of systemically optimal locations with systemically optimal technologies of production and transportation will be expedient to implement if its internal rate of return is greater than the corresponding normative indicator, which depends on the industry, type of investment, country and region.

Thus, the justification of "what, where, how, how much and for whom" to produce should take place in four stages. At the first stage, a list of attractive places of production is formed and a selection for each attractive place of production is carried out with reference to the option of the sales market (to take into account the production capacity) of a locally optimal production technology from the list of possible ones (point competition of production technologies): as a result, for each attractive place of production with reference to the option of the sales market, only one (optimal) technology out of many possible ones is identified. If a specific attractive place of production is linked to several options of the sales market, then the locally optimal production technology should be selected from the list of possible ones every time (for each link to the option of the sales market). Theoretically, this can, under certain circumstances, determine the expediency of placing several enterprises producing the same products in one attractive place of production.

At the second stage, the choice of the locally optimal transportation technology between each attractive place of production and all potential sales markets of the corresponding sales market option is substantiated. At the same time, the costs of not individual transportation between each attractive place of production and each potential sales market are optimized, but the costs of system transportation between each attractive place of production and all potential sales markets of the corresponding sales market option (point competition of transportation technologies).

At the third stage, the choice for each sales market option (based on the indicator of the minimum total costs for production and transportation) is substantiated for the choice of locally optimal production technology (among competing locally optimal production technologies in attractive production locations of this sales market option) and transportation (among competing locally optimal transportation technologies between each attractive place of production and all potential sales markets of this sales market option) and thereby identifying the locally optimal location of production (local spatial competition of production technologies and transportation technologies). As a result, only one attractive place of production of each variant of the sales market becomes a locally optimal place and, accordingly, the locally optimal production technology at this attractive place of production will become the locally optimal production technology at the locally optimal place for the corresponding variant of the sales market, and the locally optimal technology of transporting the good between locally optimal place and all potential sales markets of this sales market variant - locally optimal transportation technology. That is, for each variant of the sales market, there will be only one locally optimal production technology in an attractive place of production, which will turn out to be a locally optimal place, among all locally optimal production technologies of attractive places of production of this variant of the sales market, and the corresponding technology of transporting the good (locally optimal) between the locally optimal location and all potential sales markets for this sales market option.

At the fourth stage, locally optimal technologies of locally optimal places will compete as components of options for potential systemically optimal places (systemic spatial competition of production technologies and transportation technologies). At the same time, competition of locally optimal places is theoretically possible not only with other locally optimal places, but also with itself in various variants of potential systemically optimal places, where there is a corresponding locally optimal place. At this stage, a choice is made among competing options of potential systemically optimal places of optimal production. As a result, the locally optimal technologies of the corresponding locally optimal places form an optimal system of production technologies and transportation technologies between the locally optimal places, which turned out to be systemically optimal places, and the potential sales markets of the corresponding sales market options. At the same time, the number of locally optimal locations can be from one (if production will take place in one place for all potential sales markets) to the total number of potential sales markets (if production will take place in a separate location for each potential sales market).

3. Conclusions

A spatial-systemic approach to justifying the choice of what to produce (what goods), where to produce (locations), how to produce (with the help of which technologies in each place), how much to produce (in what amount in each place), for whom to produce (sales markets in each place) is quite revolutionary, but its validity and, as a result, its correctness are not in doubt. The justification of "what, where, how, how much and for whom" to produce should be carried out comprehensively, interdependently and mutually coordinated, since all these five parameters are optimized together within the limits of one task.

In the further study of "what, where, how, how much and for whom" to produce, it is advisable to focus on the problems of the production range. This means the need to expand the study of the complexity of production in the direction of the "set of goods", which should be produced in the appropriate places using the appropriate technologies, in the appropriate volumes, and for the appropriate sales markets.

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