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RESEARCH ARTICLE

A Three-Dimensional Matrix Model for Determining the Optimal Strategic Choice for a Company

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Abstract

This research develops a three-dimensional matrix model based on the principle behind the GE/McKinsey matrix and the hodograph method, providing a functionality to select a time series of the optimal strategies, which maximize the long-term competitive advantage and performance of a larger company in the rapidly changing business environment. The selection of such strategies is based on the comparative analysis of alternative trajectories of a company's strategic position in the model space, which is formed by three coordinate axes: the "level of a company's competitive advantage" (x), "favorability of the business environment" (y), and "time" (t).

Keywords

Company Strategy · Matrix · Polycyclic Environment

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Introduction

Significant current and predicted future changes in the business environment necessitate a company's efficient adaptation, which involves formation of long-term optimal reactions to such variability. These reactions, seen as strategies, make an issue of developing strategic planning tools and methods of interest to both academics and practitioners across the globe.

The three-dimensional matrix model proposed in this research allows a larger company to select a time series of optimal strategies accounting for the rapidly changing environmental conditions. The development of this tool is based on the principle behind the GE/McKinsey matrix and the hodograph method, providing for a comprehendible graphical representation of sustainable strategic choices.

Theoretical basis

Three modeling preconditions form the theoretical basis of this research:

A) We consider a company's strategy as a long-term interactive and proactive response to the influences of the business environment [12]. That is, a strategy is viewed as an instrument of optimal adaptation to the current and potential environmental variability, the criterion of such adaptation being maximization of the long-term competitive advantage and performance of a company under the given environmental conditions.

This definition includes both adaptive and modifying elements, unlike the majority of existing definitions of a strategy: as a means by which an organization is achieving its long-term goals; approaches to achieve the specified performance; a means to set goals for corporate, business, and functional levels; setting the main long-term goals and objectives of a company and developing the courses of action to achieve them; a plan, model, position, perspective, maneuver, and so forth [1, 5, 10, 19, 20, 24, 27]. The adaptive element of a strategy is either the interactive reaction, which is formed by a company to the current long-term environmental influences, or the proactive response formed as a current response to the future environmental influences projected with some degree of probability based on observed trends. An example of the adaptive element is a company's current reaction to the projected future financial and economic crisis.

The modifying element of a strategy is the proactive response of a company to the future environmental influences, which can be altered, such as consumer behavior. An example of this impact is affecting consumer behavior to create future demand for a new product, like changing tastes of active youth from beer to energy drinks by positioning the latter as a sport- and night-life associated image product at the beginning of this century.

B) We suggest that influences of all basic factors (the consumer, supplier, competitor, internal environment, and macro environment) can be formalized into correlated and independent patterns or recurring regularities [13], in particular, within the framework of the Y.V. Yakovets concept of the polycyclic dynamics of business environment that is one of the initial assumptions of this research [32]. An example of such pattern would be cyclical fluctuations in the level of business activity.

Y.V. Yakovets theory considers the total environmental variability as a set of nested, correlated, and independent economic and non-economic cycles, as well as non-cyclical trends. He further develops ideas of J.W. Forrester [7], B.J.L. Berry [2], and J.A. Schumpeter [22] on the nested nature of interrelated economic cycles of different lengths (the economic polycyclic theory) by adding non-economic cycles, such as: ecological, demographic, scientific and technical, social and political ones to the overall representation of the business environment. These polycyclic theorists mentioned above incorporated a wide range of individual economic and non-economic cyclic theories, such as those of J. Kitchin [11], C. Juglar [9], K. Marx [16], A.L. Tchijevsky [26], S. Kuznets [15], N.D. Kondratieff [14], A.G. Frank [8], G.D. Snooks [23], S.A. Nefedov [21] and F. Braudel [3], S.M. Menshikov [17], A. Toffler [28], O. Spengler [25], A. Toynbee [29], M. Milankovitch [18], etc.

For purposes of clarity, we formalized and structured only a fragment of the total environmental dynamics into a few main economic and non-economic cycles since 1780 in order to illustrate polycyclic theory application in the optimal strategy development for a company (Fig. 1).

The main macro-economic pattern identified is the economic Juglar–Kondratiev–Snooks polycyclic wave with the upper turning point around the year 2000. The 300–500 year G.D. Snooks superlong wave [23] that originated during the Industrial Revolution consists of the 40–60 year Kondratieff cycles [14], which have nested medium-term 7–11 year Juglar cycles [9]. This economic polycyclic wave is interdependent with non-economic macro patterns: demographic, scientific and technological, climate, social and political, and other cycles as well as various polynomial trends of the volume of natural resources, pollution, and so forth. As a result of the simultaneous analysis of macro patterns mentioned above, several alternative scenarios can be defined for future environmental dynamics. According to one of them, the phenomenon of the World Financial and Economic Crisis of the 2008–2010 is the beginning of a long-term recession in the world economic system intensified by the coinciding global long-term ecological and demographic, as well as projected world food crises by 2050 [4].

The global patterns discussed above determine micro-environmental patterns, such as those in consumer behavior, that primarily affect strategy development for a company.

C) The method we use for development of optimal strategies within the proposed matrix model is based on our definition of strategy and involves:

- identifying interdependent patterns in the influences of all basic environmental factors: consumer (behavior patterns), supplier, competitor, macro-environment, and internal-environment;
- matching the main identified patterns or recurring regularities in consumer behavior with optimal strategies, which lead to maximization of the company competitive advantage and performance;
- adjusting the selected set of optimal strategies or a multicomponent strategy taking into account patterns of the other basic factors (the "supplier", "competitor", "macro environment", and the "internal environment"), which determine environmental limitations (opportunities) for these strategies' implementation.

An example of one of the main contemporary patterns of consumer behavior at the food market is the following:

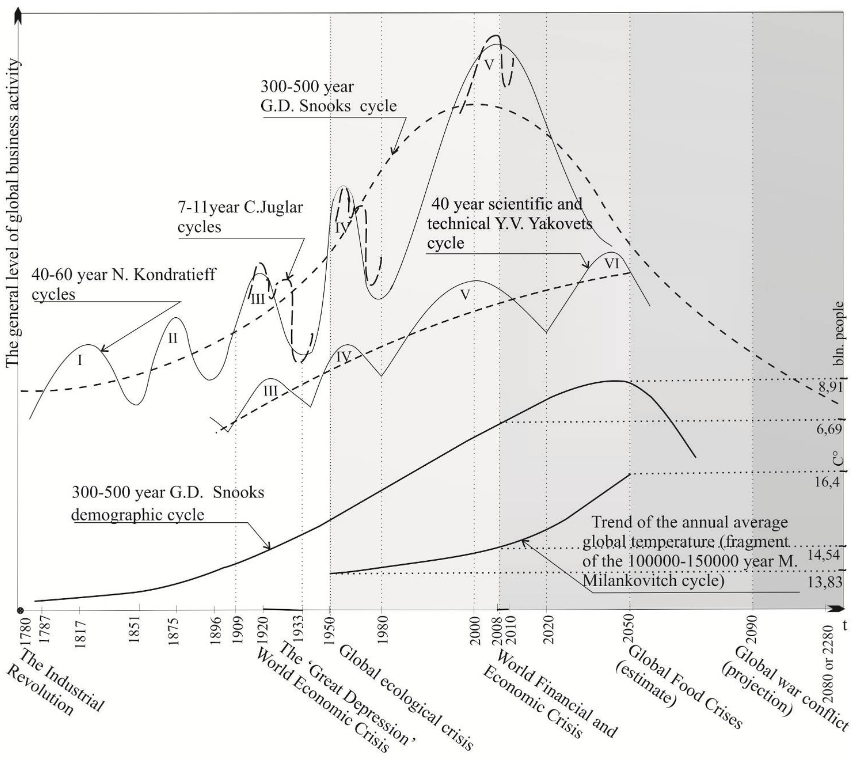
$$y_{1\_1980-2013} = \circlearrowleft [\text{Consuming "trendy" foods and beverages in public for purposes other than nutrition}].$$

The symbol $\circlearrowleft$ used above indicates that the process in the brackets [] is repeated multiple times during the given time period $t = 1980 - 2013$. One of this pattern's realizations is status consumption of beer and energy drinks associated with a social status, enjoyable communication with friends, active life style or desire for freedom and liberation, rather than traditional consumption for nutrition purposes.

The considered pattern ($y_{1\_1980-2013}$) is formed by and aims to satisfy the motive $m_{1\_1980-2013}$: "Joining a target social group, such as a youth group, sports team or a professional association, and establishing a personal image in it through foods and beverages consumption".

To maximize competitive advantage by finding the exact match between the demand and a company's supply, an optimal strategy corresponding to this pattern ($y_{1\_1980-2013}$) should best satisfy the motive ($m_{1\_1980-2013}$). An example of such strategy could be "product image adjustment to match the potential buyers' personal image" implying the development of such an image for a product that its acquisition will contribute to a customer's personal image (like positioning beer as an element of social pop culture). Thus, consumption motives must simultaneously govern the consumer behavior and the company's strategy

Fig. 1. A fragment of the polycyclic environmental dynamics



development in a way that the both processes are directed to most fully satisfy these motives (Fig. 2).

As a result of this method's application a company will develop a set of optimal strategies, which, under the environmental limitations (opportunities), best satisfy and enhance those motives of consumption that form the main patterns of consumer behavior [12].

Model description

The model space is the first octant ($OXYT$) of the left-handed three dimensional Euclidean space formed by three mutually perpendicular coordinate axes (x, y, and t), as shown in Fig. 3. The first octant is the part of the coordinate system in which all three coordinates are positive.

Using the principle behind the GE/McKinsey matrix, the proposed model generalizes the x-axis and y-axis as the "level of a company's competitive advantage" and "favorability of the business environment" respectively, the t-axis being the "time period".

In the model space, planes parallel to XOY, each corresponding to a certain time period or t-coordinate, are called competition planes in this research. Coordinates of the t-axis are consecutive numbers $(0, 1, 2, \ldots, n)$, which indicate periods of strategy implementation or strategic periods of varying lengths, so competition planes can be associated with unequal time periods.

A point mapped in such a competition plane (for example, point A in the plane XOY) is viewed as a company's strategic position incorporating integral indicators for competitive advantage (x-coordinate of the point) and environment favorability (y-coordinate of the point). The level of a company's competitive advantage (x-coordinate) and favorability of the business environment (y-coordinate) are calculated by first identifying factors for each, then determining these factors' quantitative values and weightings on the scale from 0 to 1, then multiplying the values by corresponding weightings, and summing up the results for x and for y to obtain quantitative measures for both, as shown by formulas (1) and (2) respectively:

$$x_{t_{(j)}} = \sum_{i=1}^{m} f_{it_{(j)}} \cdot w_{it_{(j)}} \qquad (1)$$

$t_{(j)}$ beginning ($j = 0$) or end ($j = 1$) of the "t" time period of strategy implementation: $t_{(0)}$ – beginning and $t_{(1)}$ – end

$x_{t_{(j)}}$ a quantitative measure for a company's level of competitive advantage in the beginning (if $j = 0$) or end (if $j = 1$) of the "t" time period

$f_{it_{(j)}}$ values of factors for $x_{t_{(j)}}$

$w_{it_{(j)}}$ weightings of factors for $x_{t_{(j)}}$

$$y_{t_{(j)}} = \sum_{i=1}^{m} f^{*}_{it_{(j)}} \cdot w^{*}_{it_{(j)}} \qquad (2)$$

$y_{t_{(j)}}$ a quantitative measure of favorability of the business environment in the beginning (if $j = 0$) or end (if $j = 1$) of the "t" time period

$f^{*}_{it_{(j)}}$ values of factors for $y_{t_{(j)}}$

$w^{*}_{it_{(j)}}$ weightings of factors for $y_{t_{(j)}}$

The horizontal OX axis of the proposed matrix indicates a company's level of competitive advantage that is determined by factors (f_i) such as the following:

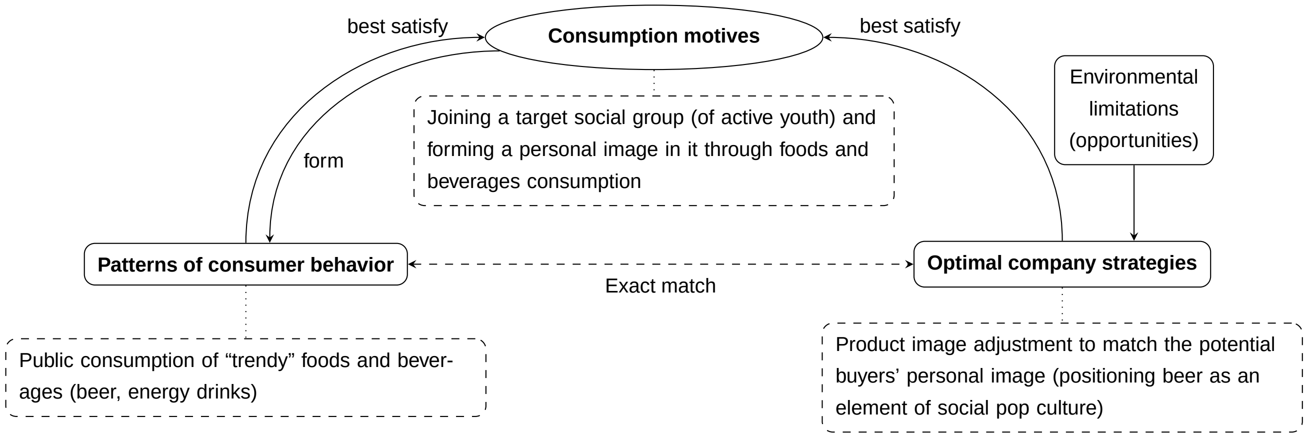


Fig. 2. A method of developing the optimal strategies for a company

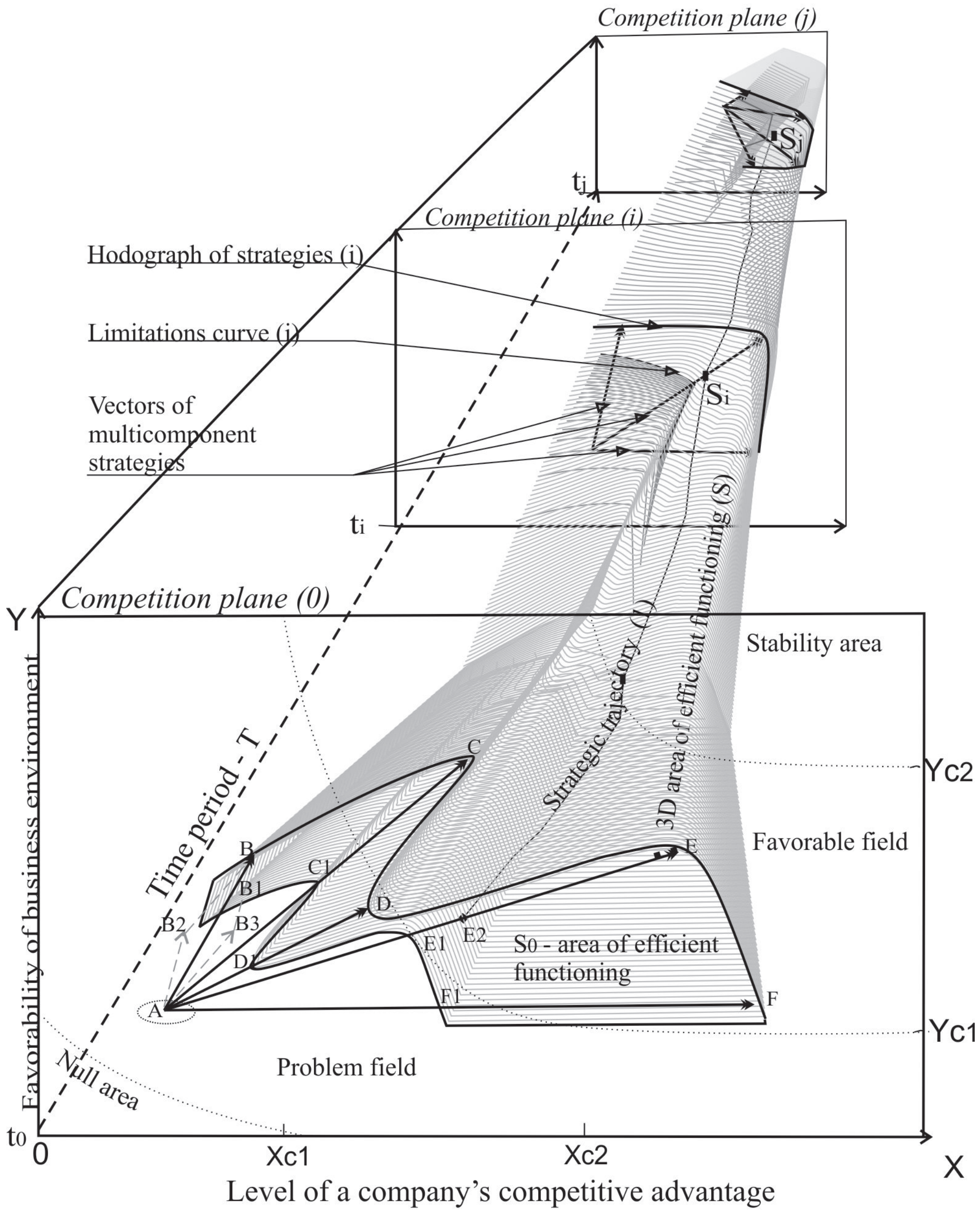


Fig. 3. A three-dimensional matrix model of the optimal strategic choice

- Long-term profitability relative to competitors;
- Total market share relative to competitors;
- Growth in total market share relative to competitors;
- Financial performance stability relative to competitors;
- Size and efficiency of the distribution network;
- Main products' competitiveness;
- Customer base and loyalty relative to competitors;
- Level of innovative activity relative to competitors;
- Production capacity relative to competitors;
- Level of product diversification relative to competitors;
- Level of a company's change resilience relative to competitors, etc.

The vertical axis (OY) of the matrix indicates the favorability of the business environment. Some groups of factors (f_i^*) that can be used to determine environmental favorability include:

- The demand structure and dynamics;
- Main markets' growth rates and sizes;
- Changes in patterns of consumer behavior;
- Number and significance of competitors;
- Main resources' price and availability;
- Patterns in macro influences: probability of the cluster of global crises, population income tendencies; environment pollution trends, technological tendencies, etc.

Let us assume the initial strategic position of a certain company is $A(x_{0_{(0)}}, y_{0_{(0)}}, 0)$ – point A with a neighborhood on the XOY plane, $t = 0$ (Fig. 3). The first strategic period, indicated as $t = 0$ and associated with the XOY plane, can be of any length. Implementation of the first set of individual strategies (which we call a multicomponent strategy) will result in the displacement of the initial strategic position (A) to some final strategic position in the same XOY plane, for example, to $E_2(x_{0_{(1)}}, y_{0_{(1)}}, 0)$ at the end of this period. Then the graphical representation of a multicomponent strategy in a competition plane is a vector (such as $\overline{AE_2}$ in our example), the length of which indicates the strategies' efficiency.

When the first strategic period ($t = 0$) is over, we consider the second strategic period ($t = 1$) of arbitrary length and, consequently, the next competition plane, in which the initial strategic position $A^*(x_{1_{(0)}}, y_{1_{(0)}}, 1)$ has the same x- and y-coordinates as the final position of the previous period $E_2(x_{0_{(1)}}, y_{0_{(1)}}, 0)$, that is, $x_{1_{(0)}} = x_{0_{(1)}}$ and $y_{1_{(0)}} = y_{0_{(1)}}$.

Once the second set of individual strategies is implemented (in period $t = 1$), a new vector is plotted to represent it in the second competition plane and so forth.

If this procedure is repeated engaging several competition planes in the three-dimensional model space, we can connect all endpoints of the obtained vectors (each representing a multicomponent strategy) to map a trajectory showing dynamics of a company's strategic position over time (such as Strategic trajectory (1) in Fig. 3).

Furthermore, several options of the optimal multicomponent strategy for a company can be plotted in each plane, such as vectors $\overline{AB}$, $\overline{AC}$, $\overline{AD}$, $\overline{AE}$, $\overline{AF}$ in XOY. Then the proposed model can be used to select a time series of the optimal multicomponent strategies for a company (one multicomponent strategy in each competition plane) based on the comparative analysis of alternative strategic trajectories.

Implementation of an optimal multicomponent strategy leads to an increase in the level of competitive advantage (x) and/or environmental favorability (y) and can be visually represented in a competition plane as a vector with directions ranging from straight up to straight right. For example, vectors $\overline{AB}$, $\overline{AC}$, $\overline{AD}$, $\overline{AE}$, $\overline{AF}$ in the XOY plane are all optimal multicomponent strategies of the first time period ($t = 0$). Out of these five strategies a company chooses only one relying on projections made about locations of final strategic positions (coordinates of points B, C, D, E or F) and estimated probabilities to achieve these positions considering environmental limitations and opportunities.

The most preferred is the maximum displacement of the strategic position of a company towards the upper right part of the plane as shown by vector $\overline{AE}$ on XOY. That is, the optimal strategic choice of one multicomponent strategy-vector in a plane is carried out by, first, comparing parts of the plane where alternative final strategic positions are mapped. Each competition plane is divided into four parts: "null area", "problem field", "favorable field", and "stability area" (Fig. 3). The least favorable is the "null area", for which near zero coordinates for x and y are typical. The "favorable field" and "sustainable area" have high and maximum environmental favorability and the level of competitive advantage, while the "problem field" encompasses unstable strategic positions. These parts' borderlines are marked using the following critical values $Xc1$, Xcr, Ycr, $Yc2$ of the coordinates.

A vector representing an optimal multicomponent strategy is the sum of vectors representing optimal individual strategies, such as, $\overline{AB_2}$ and $\overline{AB_3}$ constitute $\overline{AB}$, that is, $\overline{AB} = \overline{AB_2} + \overline{AB_3}$. To provide an example of these strategies, we will consider Enni Foods Inc. [6] – one of the main producers of instant food products (dry mixes for soups, muffins, cereal, and cake icing), coffee, and spices in Ukraine. The company is also one of the oldest food companies in the country, having being founded in 1862.

In the strategic period $t = 2003 - 2012$, one of the main elements of the multicomponent strategy $\overline{AB}$ was the $\overline{AB_2}$ strategy, which included "introduction of a growing variety of new instant coffee blends with variations of organoleptic characteristics (branded as "Coffee Up") and increasing its' share at the national market of active youth". The assortment of this brand included mixes of various types of high quality coffee from Asia, Africa, and Latin America in bright colored coffee jars, providing different tastes and scents comparable to popular energy drinks.

This strategy can be considered optimal at this time because it satisfied one of the dominant consumption motives $m_{1\_(1980-2013)}$ "Joining a target social group and establishing interpersonal relations (image) through food consumption", which was discussed above. In its turn, this motive (m_1) formed the following consumer behavior pattern:

$$y_{1\_1980-2013} = \cap \text{ [Consuming "trendy" foods and beverages in public in order to gain acceptance into a social group and to form an individual image in it]},$$

which is widely present in the food market today. Thus, we can indicate that $\overline{AB}_2$ strategy matched one of the main consumption patterns ($y_{1\_1980-2013}$) and, consequently, was optimal.

Although the strategic choice was correct, $\overline{AB}_2$ was not fully implemented, as instant coffee appeared too traditional and not convenient enough for public image consumption in youth groups, while energy drinks are widely available and easy to consume. As a result, only a few varieties are now present at the southern market of the country.

Another element of the multicomponent strategy since 2011 has been $\overline{AB}_3$ strategy, which included "organization and development of all-natural "healthy" instant food production in the middle price segment". This strategy can also be considered optimal as it matched the emerging new food consumption pattern: "consuming healthy fast food products taking into account time and cost considerations". The strategy $\overline{AB}_3$ was realized close to its full potential. Thus, by the year 2013, as a result of $\overline{AB}_2$ and $\overline{AB}_3$ implementation, the company's strategic position has not reached the B point of full potential, the final strategic position being located in the BB_1 segment of the vector $\overline{AB}$.

Since point A (initial strategic position on XOY) is the starting point of all the vectors $\overline{AB}$, $\overline{AC}$, $\overline{AD}$, $\overline{AE}$, $\overline{AF}$ representing alternatives of optimal multicomponent strategies for this period ($t = 0$), then the plane curve $BCDEF$ connecting these vectors' endpoints is called a hodograph. Such a hodograph of strategies is plotted in every competition plane and shows the borderline of the highest attainable strategic positions, which can potentially be achieved if alternative strategies are to be fully realized and the best case scenario of environmental development is to take place. The second hodograph on the XOY plane is the $B_1C_1D_1E_1F_1$ curve, also called the limitations curve, as it connects the final strategic positions if the alternative multicomponent strategies are to be realized to the minimum extent in the worst-case scenario of the environment development. Consequently, the estimates of the actual final strategic position corresponding to the strategic alternatives $\overline{AB}$, $\overline{AC}$, $\overline{AD}$, $\overline{AE}$, $\overline{AF}$ are the segments B_1B, C_1C, D_1D, E_1E, F_1F correspondingly. The smaller the segment, the more accurate is the final strategic position's estimate.

From the aforementioned, on the first plane we can select the optimal strategy $\overline{AE}$ as a result of comparing distances B_1B, C_1C, D_1D, E_1E, F_1F and locations of positions B, C, D, E, F in relation to the four parts of the plane. The point $E2$ in Fig. 3 is an example of where the actual final position can be located after $\overline{AE}$ is implemented.

Then the area S_0 between the two hodographs provides an estimate of the actual location of the strategic position in the XOY plane at the end of this period ($t = 0$) regardless of which alternative of the optimal multicomponent strategy is implemented. We call the plane figure S_0 the area of a company's efficient functioning. If a company selects any one of optimal multicomponent strategies in XOY, its final strategic position will be placed within S_0 ensuring an increase in the competitive advantage and/or environmental favorability vis-à-vis its initial strategic position (A).

Considering hodographs in different competition planes over time, for example, those on planes (0), (i) and (j), the areas of efficient functioning (S_0, S_i and S_j) will be of different shapes and can be considered cross-sections of a three dimensional figure S containing the multitude of a company's efficient strategic positions over time. Consequently, the strategic trajectory should be kept within the figure S, which is assured by selecting any one of the optimal multicomponent strategies.

Both hodographs and areas of efficient functioning (S_i) will vary in shapes in different competition planes depending on the general dynamics of business environment that is viewed within the framework of the Yakovets polycyclic theory discussed above.

As the overall favorability of the business environment increases, for example before the 1950s when we observe simultaneous expansion phases of economic and non-economic cycles in Fig. 1, the vectors representing optimal multicomponent strategies are mostly pointed from straight up to diagonal right in the matrix, such as in competition plane (0) of Fig. 3. The number and lengths of these vectors increase indicating a greater number of optimal strategic choices and their potential efficiency. The area of efficient function (S_i) will become smaller as actual and theoretically attainable final strategic positions are mutually closer. In the event of a cluster of economic and non-economic crises, there would be fewer vector-strategies, they would be pointed straight right and down, while the area of S_i would be larger, as show in plane (j) of Fig. 3. In this unfavorable environmental situation the figure S, indicating the three-dimensional efficient function region of the matrix, would twist to the right and expand. It is caused by the fact that the limitation curves move closer to the initial strategic positions, while upward displacement of the strategic position is not likely due to the increase in environmental limitations. Consequently, the proposed matrix model can also be applied to project general polycyclic environmental dynamics, as the shape of the three-dimensional S-figure changes depending on phases of the main cycles.

Conclusion

The three-dimensional matrix model developed in this research is for determining a time series of the optimal strategies for a larger company in the rapidly changing business environment. It is our hope that this strategic tool, which is based on the principle behind the GE/McKinsey matrix and the hodograph method, will be of interest to both management scholars and practitioners, as it provides:

- a means to develop and compare alternatives of optimal multicomponent strategies (sets of individual strategies) in individual competition planes, each associated with a certain time period and formed by x-axis of the level of a company's competitive advantage and y-axis of the favorability of the business environment;
- a procedure to map and compare alternative trajectories of a company's strategic position over time in the three-dimensional model space, and then select the optimal trajectory maximizing the company's competitive advantage and performance under the rapidly changing environmental conditions;
- an ability to monitor the main rhythms in the total dynamics of the business environment, project its future influences, and adjust strategic choices accordingly.

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