Chapter 16

The Method of Soft Computing in Strategic Management

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A new approach to strategic management is proposed, based on qualitative methods of surveying an organization using the method of soft computing. There are many examples of assessing the risk status of an organization. The particular importance is the designing of a reference model as a future image of the organization. The new approach enables qualitative diagnostics, risk assessment, and strategic decision-making. Indicators and parameters are developed separately for different industries. The method is used for assessment and analysis of the state of safety and business performance of the organization, for compiling integrated ratings of local, and international industry markets.

16.1 Introduction

Well-known modern theories and methods of strategic management contain diagnostics of the state of organizations, analysis, development of guidelines, and planning for the implementation of the goal. A new approach to strategic management is proposed, based on qualitative methods of surveying an organization using the method of soft computing (SC). The basis for the development of the method was the works [1, 2] and others. There were postulated universal concepts of effective management by qualitative assessments of objects of various natures [3, 4]. The beginning of SC is human thinking The guiding principle is: "tolerance for inaccuracy, uncertainty, and partial truth to achieve ease of manipulation, robustness, low-cost solutions, and better agreement with reality" [1]. The calculation is possible according to selected parameters, and a set of indicators. There are many methods of simply assessing the states of any object.

The content of the method is revealed in a practical application on the example of an air transport organization - an airline. A comparison of traditional analysis and business planning, empirical models, and the SC method of the principal components of business activity is shown. The new approach enables express diagnostics, risk assessment, and strategic decision-making.

16.2 Method of Soft Computing

The concept and foundations of the method of SC were previously presented in [5]. Since the method is a relatively new direction in informatics, more detailed descriptions are given in this paper starting with the formal SC definition output.

16.2.1 Formal Soft Computing Definition Output

To output the definitions of SC, let's accept the following justification for the observed (measured, estimated) boundary values of object properties (Fig. 16.1).

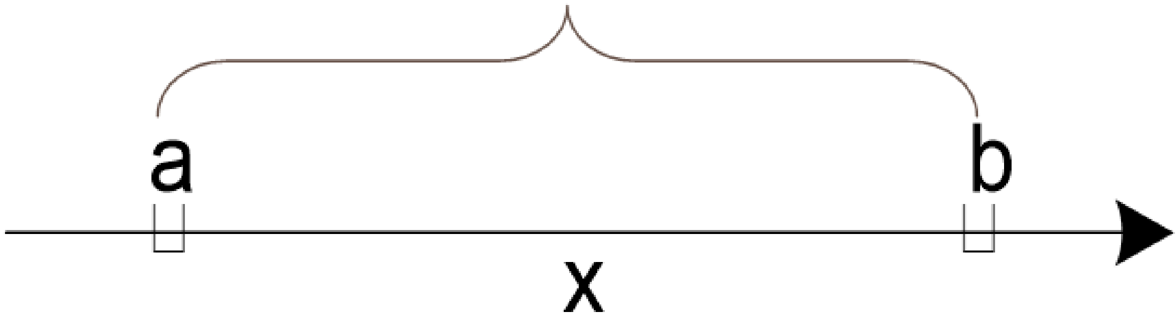

Figure 16.1: SC definitions output.

Let the segment [a, b] contain subsets of the observed values of the value X belonging to the set R (Eq.

$$x \in X \subset [a,b] \in R \tag{16.1}$$

Let's enter the following conditions for calculating object values.

- Condition A: The values of the observed quantities belong to any of the subsets, including the values a and b:

$$x \in [a,b] \text{ or } a \leq x \leq b$$

Definition 16.1. *Setting the values of the observed quantities by the condition A is called the method of hard estimation (evaluation) (HE), which calculates the exact (point) values of the values $x \in X$ of the two (both) boundaries of the segment [a, b] belonging to the set R.*

- Condition B: The values of the observed quantities at point [a] do not belong to any of the subsets:

$$x \in [a,b] = [a,b]/\{b\} \text{ or } a < x \leq b$$

- Condition C: The values of the observed quantities at point [b] do not belong to any of the subsets:

$$x \in [a,b] = [a,b]/\{a\} \text{ or } a \leq x < b$$

Definition 16.2. *Setting the values of the observed quantities by the conditions B and C is called the soft measurement (SM), which sets the calculation of exact (point) values of values $x \in X$ for only one (any) of the boundaries of the segment [a, b] belonging to the set R.*

- Condition D: The values of the observed quantities in the region [a, b] do not belong to any of the subsets:

$$x \in [a,b] = [a,b]/\{a,b\} \text{ or } a < x < b$$

Definition 16.3. *Setting the values of the observed quantities by the condition D is called the soft estimation (evaluation) method (SE), which calculates the exact (point) values of the values $x \in X$ of none of the boundaries of the segment [a, b] belonging to the set R.*

Thus, let us do SC's general formal definition output.

Definition 16.4. *Soft computing is a set of metrics: hard estimation (HE), soft measurement (SM), and soft estimation (SE) in metric and non-metric scales with the ability to process simultaneously quantitative numerical and qualitative linguistic data.*

The presented interpretation of SC can be considered as the notion of the power of a finite universal set Ω, where fuzzy (soft) measures (Eq. 16.2):

$$\Omega : \mu_{SM}, \mu_{HE}, \mu_{SE}, \tag{16.2}$$

where terms of the equation are indicators of data inaccuracy (Fig. 16.2):

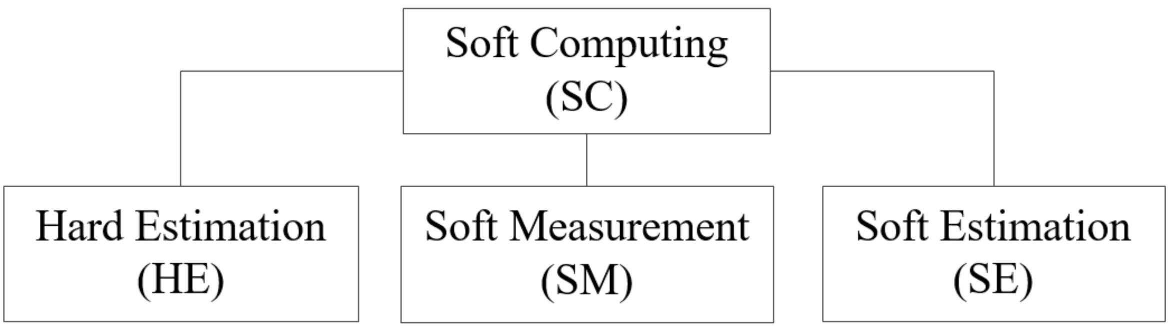

Figure 16.2: Soft computing structure.

The powers of these measures are minimal for single-point sets. The most accurate values of the objects are measures μ_{SM}, less accurate μ_{HE}, and the highest inaccuracy measures have μ_{SE}, in the limiting case $\mu_{SE}\Omega$. The most significant part of the values of the properties and states of organizations, social groups, and people is determined by the SC methods used in conjunction with the heatmap model, the "traffic light" model.

16.2.2 Soft Computing in Displaying Transitions of the Object States

These metrics definitions evaluate the states of objects for regulatory and organizational control. Let the object (O_i) have resource states (r_j), that are related to the destination objective function as follows (Eq. 16.3):

$$O_i : \{r_{(1,2,3)}\}, \tag{16.3}$$

where r_1 - compliance with the nominal state; r_2 - compliance with an acceptable state; r_3 - match unacceptable state.

In the term "nominal" of the state r_1, the value of satisfaction of the assignment function is embedded. In the term "acceptable" state r_2 is the value of acceptable activity with possible failures. In the "unacceptable" state term, r_3 is the value of the invalid activity. Transitions to the states r_2 and r_3 must be set as specific values. By the accepted definition of SC, soft transitions are denoted by: (parentheses) and hard transitions [square brackets]. The state record will take the following form:

- $r_{(1)}$ – compliance with the nominal state of the vehicle with the left and right fuzzy boundaries established by the SE method;
- $r_{[2)}$ - correspondence to an acceptable state with a left clear boundary, established by the SM method or the HE method, and a right fuzzy boundary, established by the SE method;
- $r_{[3)}$ - correspondence to an unacceptable state, with a left clear boundary established by the SM method or the HE method and a right fuzzy boundary, the right fuzzy boundary has the meaning of transitions to the states of an unknown, new space of life activity, established by the SE method. The transition record takes the form (Eq. 16.4):

$$O_i : \{r_{(1)} \to r_{[2)} \to r_{[3)}\}, \tag{16.4}$$

where each represented transition is called ascending and is set by clear boundaries.

Recording three state transitions is an example of applying the derivation of the SC definition. The state structure can consist of more levels. The display of clear and fuzzy state transitions demonstrates a mixed, pseudo-physical [2], quantitative, and non-quantitative relationship of the SC values of objects. These mappings are the basis for the development of life risks and SE risk matrices and are used in combination with "traffic light" heat maps [6].

16.2.3 Soft Computing in the Heatmap Model

Risk matrices that are used in risk management methods, in the context of this work, are tools of the SC method. In risk matrices, a color indication of cells or the principle of "heat map" is used. The simplest analog of a heat map is a “traffic light”: green-yellow-red. In the SC method, the principle of “traffic light” color indication is used with the addition of a digital designation: 1 - green, 2 - yellow, and 3 - red. By the SC method, two clear boundaries of transitions [square brackets] between subsets 1-2, 2-3 and two fuzzy boundaries (parentheses) corresponding to the left values of subset 1 and the right values of subset 3 are established (Eq. 16.5):

$$\text{"TRAFFIC LIGHT"} : \{(1-\text{green}), [2-\text{yellow}), [3-\text{red})\} \tag{16.5}$$

The properties of the object observed in the parameters and the indicators have different measures of clarity (Table 16.1):

Table 16.1: Assessed indicators according to the “traffic light” principle

Borders	Number	Color	SC	Scales	Values
Fuzzy	1	green	SE	naming	names
Clear	2	yellow	SM	order	numerical
Fuzzy	3	red	HE	intervals	intervals

Each indicator is expertly assigned the most appropriate scale for the nature of the property, the value is set: names, numbers, numerical intervals, or links to additional, more structured sets. Levels 1, 2, and 3 are "improvement-deterioration" transitions of the states of the object’s properties. To display values in the “traffic light” structure, a general rule is set:

Definition 16.5. *For all indicators I_i the transition: $\forall I_i\{1 \rightarrow\uparrow 2 \rightarrow\uparrow 3\}$ from left to right (ascending) from the best to the worst state is set more hardly (HE, SM); the transition: $\forall I_i\{1 \downarrow\leftarrow 2 \downarrow\leftarrow 3\}$ from right to left (descending) from the worst to the best state is established more softly (SM, SE).*

The application of SC methods is carried out as follows:

- For the space of subsets of set 1, the values of quantities are established by the SE method;
- For the space of subsets of set 2, the values of quantities are established by the SM method;
- For the space of subsets of set 3, the values of the quantities are established by the HE method.

Example: "Specialist assessment"

Parameter: "professional experience"; indicator: "work experience"; scale "intervals"; units: "years"; values are set: 1 - green [>20] years, 2 - yellow (5-20] years, 3 - red (<5] years).

The use of SC methods can have options: For the space of subsets of the set $\{1-2-3\}$, the values of the quantities are established by the SE method. Usual conditions and situations of activity. For the space of subsets of the set $\{1-2(3)\}$, the values of the quantities are established by the SM method. Conditions and situations with restrictions. For the space of subsets of the set $\{1(2)\}$, the values of the quantities are established by the HE method, for example, in emergency conditions and situations. That is, even level (2) "yellow" can be prohibited [5, 7].

16.3 Modeling and Computing the States of Organizational Objects

This paper presents practical evidence that the calculation of the states of the organization: risk, safety, and efficiency can be carried out by analyzing several performance indicators. This approach is considered as an alternative to the analytical approach. For comparison, the following are presented: an analytical model of the financial viability of the airline, and a qualitative model of "production finance". Next, the models and calculations of states by the SC method based on the natural indicators of the air carrier's operational activities are presented.

16.3.1 Airline Qualitative Solvency Model

Model "production-finance"

A similar outline is in the work [8]. It is of two-dimensional activity space that has coordinated axes: the value of the volumes (P) of production in the market is related to the number of finance costs (F).

In this model, the following description and definitions are introduced.

Definition 16.6. *The hypothetical space of the organization (airline) activities are denoted from the origin to the points* $[0\_c'\_c\_d']$ *- a universal set. Point* (d') *denotes the marginal volumes of production capacity, such as the carrying capacity of the fleet, and the number and qualifications of personnel. Point* (c') *denotes the limiting possibilities of finance. Since competitive activity in the market requires certain ratios of minimum resources "production-finance", real activity cannot be near zero space.*

Definition 16.7. *The area* $[a'\_b'\_b\_a]$ *is called the pseudo activity space and is a subset of* $[0\_c'\_c\_d']$. *Activity is possible only from a certain position* $[b\_a]$ *and impossible when approaching* $[a'\_b']$.

Definition 16.8. *The area and space of unacceptable safety spending are called the bankruptcy space* $[b'\_b\_c\_c']$.

Definition 16.9. *The space of unacceptably low safety costs and excessive production efforts is called the disaster space* $[0\_a'\_d\_d']$.

Definition 16.10. *The admissible space of activity is located in the up-right direction between the efforts of production and the financial costs of safety* $[a\_b\_c\_d]$.

Actual performance indicators at a certain time can have values $x_i\{f_n, p_m\}$, that are in the space of competitive and safe activity. Risks, indicated by the method of heat maps or the traffic light rule, are located in vertically asymmetric levels. The theoretical and practical significance of the model is as follows. (1) It is shown that there is a space of activity in which the states of safety and efficiency are achieved simultaneously and jointly by the resources of production and finance. At the same time, there is no antagonism between safety and economics. (2) In the space of acceptable activity, there are choices in the levels and indicators of financial and operational risks in which the air carrier sets strategic goals and operational plans. (3) The space of acceptable activities is located in the green-yellow levels of the risk matrices [6]. A justification is created for calculating the indicators and values of activity in the green-yellow levels, where nominal activity is carried out. Indicators of the “red” state are calculated both in the bankruptcy space and in the aviation accidents (AA) space (Fig. 16.3):

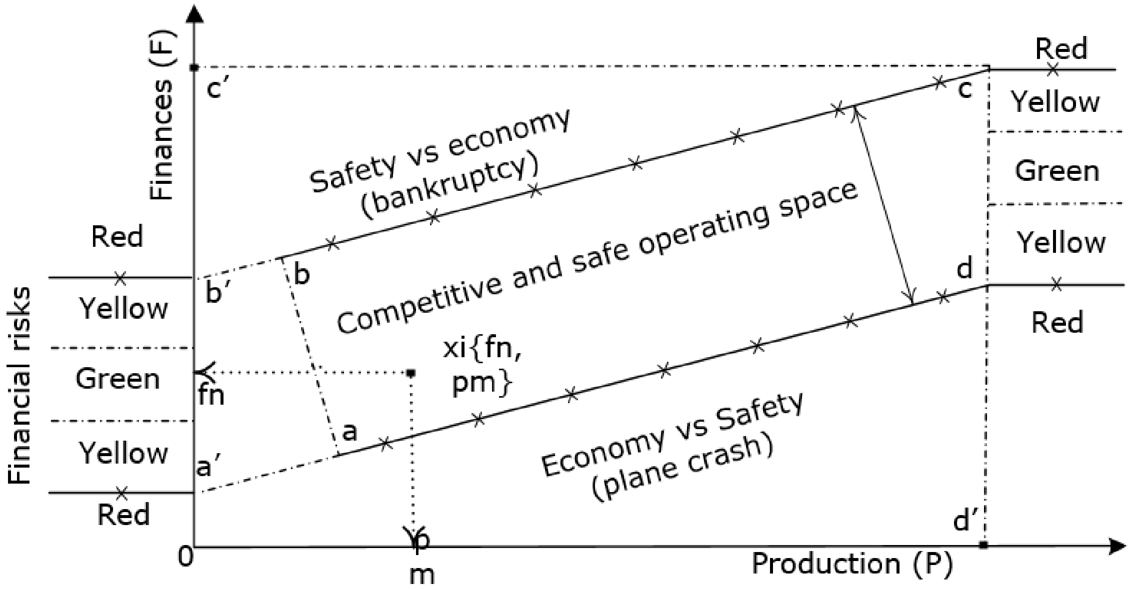

Figure 16.3: Model "production-finance".

16.3.2 Management of the States of Organization

The method based on natural indicators of nominal activity is used for strategic and operational management. The method allows normalizing indicators in ratios of indicators to parameters for evaluation of the states of organization in selected scales. When presenting and interpreting various indicators, the following provisions are postulated: a) any performance indicators, directly and indirectly, reflect both the economy and safety; b) safety is evaluated in conjunction with the economy, and vice versa; c) states of safety and efficiency are evaluated in terms of risks; d) all states are nonlinearly interconnected.

Organization Reference Model Design

An organization subjected to reorganization is called a crisis company (CC). An analysis of production activities is carried out and the values of actual indicators (AI) are displayed, which are considered crisis states of the CC. To design a strategic future, and desired states (benchmarks), a business reference model (RM) is being developed. In special procedures, a parametric analysis of CC and RM is compiled. An assessment of the efficiency and safety of the business is compiled, and a management strategy is developed. For the design of RM production activities, the external environment of the company and information about analog companies are examined. By the target indicators of the strategy of CC, reference indicators (RI) are compiled. To derive the values of RI, the market of CC is studied and a generalized model of the reference company (RC) is compiled, the indicators of which are comparable with the same of CC (Fig. 16.4):

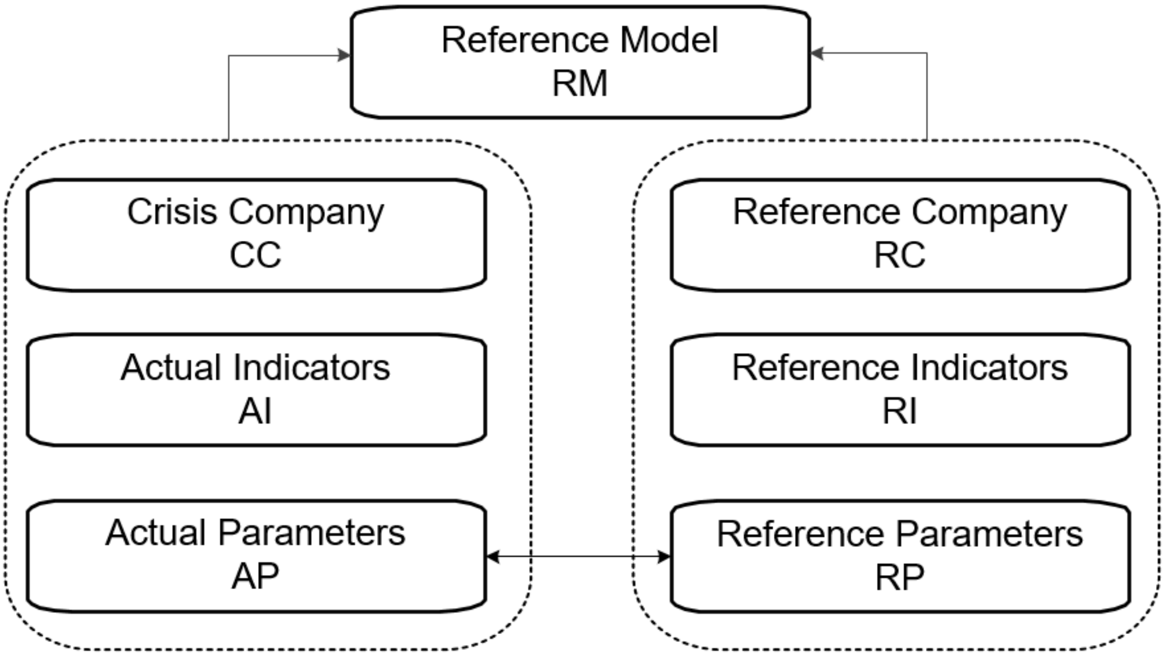

Figure 16.4: Reference Model.

Together, RI is interpreted as successful, competitive states and forms strategic activities. However, a direct comparison of the quantitative indicators of the activities of various facilities does not make it possible to assess the state of efficiency, safety, and risks. Evaluation of states is possible by parameters derived as ratios of various indicators. For indicators of CC and indicators of RM, the calculation of actual parameters (AP) and reference parameters (RP) is performed. The parameters are displayed in numbers of absolute value. To compare and display their multiplicity, the value of RC is reduced to one.

Risk Assessment Model

To assess the risks of activities through the values of the properties of an object, a model of heat maps or a "traffic light" is used in non-linear scales of clear and fuzzy areas of the risk matrix. The smallest space has a green range, the largest has a red range. To partition the intervals of indicator values, the method of estimating the likelihood of approximating the intervals is used [7]. Clear and fuzzy boundaries of the intervals are set by the definitions of the method of SC. To evaluate the values of AI and RI in the risk matrix, the following non-linear scale of fuzzy intervals is displayed in terms of numerical values of risks (Eq. 16.6):

$$\overleftrightarrow{R} = \left\{ \left(\genfrac{}{}{0pt}{}{\text{green}}{1RI < AI < 1,3RI} \right) \left[\genfrac{}{}{0pt}{}{\text{yellow}}{1,3RI < AI < 2RI} \right) \left[\genfrac{}{}{0pt}{}{\text{red}}{AI > 2RI} \right) \right\}, \tag{16.6}$$

where the boundaries of the values of the range indicators on the left and the right are set fuzzy (parentheses) and clear [square brackets].

16.3.3 Calculation of States by Selected Indicators

The calculation is possible according to selected parameters, and a set of indicators. Below are examples of assessing risk states. Following the above risk assessment model the data are divided into intervals in points and colors of a three-level risk matrix. The composition and number of indicators and parameters established empirically for different industries and sectors of the economy vary significantly. The initial data of the CC are generalized values of the airline's indicators of the Russian Federation, 1990-2012 years. The RC data are compiled according to international directories and the data of the air transportation world market. The data are divided into intervals into points and colors of a three-level risk matrix.

Calculation of States by the Structure of Operating Costs

The structure and names of the types of the classifier of operating costs of air carriers may vary depending on the purpose and size of the activity. Since the names of the indicators differ, only indicators with the same names are compared and evaluated. Below is an example of the calculation of states by the structure of expenses (Table 16.2):

Table 16.2: Calculation of states by the structure of expenses

Expenses, %	RI	AI	Risk	
			Points	Color
Salary	-	15	-	-
Flight crew	8	-	-	-
Fuel	12	22	7	Red
Sales	16	-	-	-
Depreciation	6	4	5	Yellow
Maintenance	12	4	9	Red
Passenger service	10	-	-	-
Administrative	12	-	-	-
Aeronautical and airport	18	18	2	Green
Other	6	37	10	Red

Evaluation of AI: there is weak accounting, the classifier has several empty expenditure items; there is no normal accounting and analysis of expenses since a large share of the "other" item of 37% is shown; low capital investments in fleet modernization because of vague strategy. All that is an indication of the low level of the economy and safety of the CC.

Calculation of States of the Organizational Structure

The main differences between the organizational structure of the CC and RC are the predominance of the production function and the underdevelopment of the commercial and administrative functions of the CC (Table 16.3):

Table 16.3: Calculation of states of organizational structural components

Personnel, %	RI	AI	Risk	
			Points	Color
Flight	10	35	10	Red
Maintenance	25	40	7	Red
Commercial	50	15	10	Red
Financial	5	2	6	Yellow
Administrative	10	8	3	Green
Total	100	100	-	-

All functions of the business of the CC are qualitatively inferior to the level of management of a stable market airline RM. The qualifications of administrative personnel in the CC are much lower. A large proportion of the flight personnel of the CC is a common compensator in flight, created by the troubles of control on the ground. To perform unusual commercial tasks performed by the crew of the CC, the share of flight personnel is increasing. The crisis state of the company is quite obvious.

Calculation of States According to Sociometric Data

The work [9] presents sociometric studies of airlines that are in the process of a deregulation crisis. The research consists of two parts: (1) socio-psychological assessments of 839 pilots and their families; (2) demographic diagnostics of air carrier personnel. For comparison, the averaged data of an airline in the usual competitive state is presented. To evaluate the states of CC the source data [7] for the task of this work are divided into intervals in points and colors of a three-level risk matrix (Table 16.4).

The deep crisis state of the company is also obvious. Urgent measures are needed to develop solutions to correct the state of the company.

Calculation of States Based on Demographic Data of Personnel

Demographic diagnostics [9] reveal the age characteristics of the personnel. The age of the flight personnel of RC turned out to be on average 10 years younger than the age of the CC. The changes in personnel positions were more frequent. The general assessment of the CC has the value of a crisis state, with a low level of performance and flight safety (Table 16.5).

Thus, the above examples of organizational diagnostic give immediate new information about the situation and state of any company.

16.4 The Method of Principal Components in Strategic Planning

16.4.1 Method Basics

The calculation of natural indicators of the air carrier by the analytical method determines the quantitative characteristics of the activity by a variety of accounting and analysis procedures.

Table 16.4: Calculation of states by social indicators

Indicators, %	RI	AI	Risk Points	Risk Color
General stress:				
pilots' complaints about disability	7	21	10	red
increased alcohol consumption	4	13	9	red
more than two illnesses in the last two years	5	17	9	red
drug consumption	3	5	5	yellow
consumption of tranquilizers	1.4	2.5	10	red
increased smoking	7	12	9	red
Work stress:				
due to job changes	22	45	8	red
due to business events	2	7	7	red
Family stress:				
overload	11	33	9	red
marital and child conflicts	18	32	7	red
extreme family conflicts	2	11	10	red
Stress mediators:				
the feeling of lack of self-control	11	35	10	red
low sense of self-esteem	3	12	9	red
significant feelings of self-deprecation	7	19	8	red
Depression:				
symptoms of depression	14	24	9	red
female depression	20	40	8	red
Economic forces:				
financial difficulties	3	19	10	red
feelings of economic pressure on the family	25	75	10	red
strong economic pressure on the family	10	37	8	red
Satisfaction:				
sense of recognition from the airline	7	58	9	red
airline satisfaction	4	83	10	red
optimism in outlook	1.5	49	10	red

Table 16.5: Calculation of the demographic data of personnel

Indicators	RI	AI	Risk Points	Risk Color
The average age of pilots, years	43	54	7	yellow
Job structure:				
Captains	62.7	41.5	9	red
Co-pilots	36.4	46.8	9	red
Flight engineers	0.9	11.7	10	red
Work less than 6 years on this airline	43.5	8	10	red
Work more than 10 years in the same position	10.4	22.9	9	red

Key quality indicators are the result of calculated productivity, efficiency, and intensity. The original outline of the model: Airbus Industrie, Skylink, Toulouse, 1996. The detailed development of the model was carried out later by the author of this work. The model provides a selection of indicators, parameters of the company's activities, and the basis for establishing the main components necessary for strategic management (Fig. 16.5).

To evaluate and analyze the states of an organization, several methods (property, income, comparative) are known for assessing the cost of capital, assessing investment management, and express assessment of states (bankruptcy), for example, Altman Z-score analysis [10]. In these methods, the initial data are financial indicators. The resource method of managing organizational objects is based on the derivation of the principal components as a set of indicators – parameters, displaying the organization's resources. The method allows to reduction the number and dimension of the initial data for analysis for subsequent interpretation and decision-making.

16.4.2 Definition and Analysis of Principal Components

In the economy of airlines, the 11 most important indicators have been identified. Indicators RC data received from available databases and directories are approximately equal in terms of fleet and personnel of CC. The model defines 13 principal components (parameters), which are determined by the ratio of one indicator to another indicator. Example: the number of passengers carried per year per the number of employees of the company Passengers 439379 / Employees 2284 = 186.

The calculations consist of the following procedures (P). P-1.

Calculate the annual actual performance indicators of CC (Table 16.6):

Table 16.6: Actual performance indicators of the air carrier

Indicators	Code	Values	Comment
Employees	E	2284	human resources
Airline Fleet	AF	78	value of production
Fleet Seats	FS	3343	value of capacities
ASK/RPK	CU	0.65	capacity used (load factor)
Available Seat Kilometers	ASKs	2092	passenger market
Revenue Passenger Kilometers	RPKs	1244 (regular) 116 (irregular)	passenger market activity
Available Tons Kilometers	ATKs	209	cargo market
Revenue Tonne Kilometers	RTKs	112 (regular) 24 (irregular)	cargo market activity
Annual Passengers	AP	439379	sales
Revenue thuds USD	R	47186808	operation cash
Operation Costs thuds USD	OC	59041063	operation expenses

- P-2. Compile a set of indicators for the RC in the same way as the above calculation of CC. The corresponding RC table was omitted.

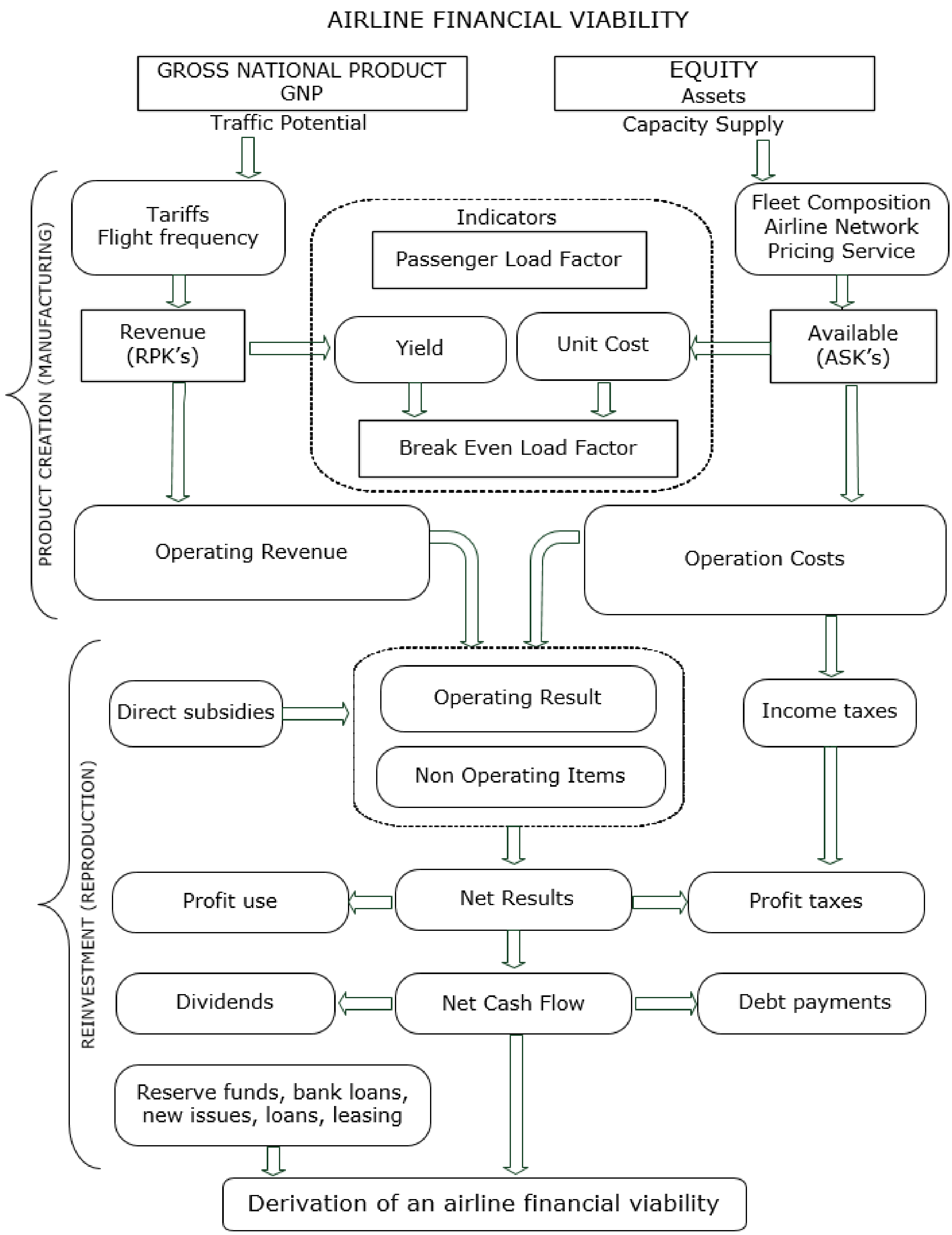

Figure 16.5: Financial viability

- P-3. Determine the principal components.
- P-4. Calculate efficiency ratios (ER) of CC (Table 16.7):

Table 16.7: Efficiency ratios of crisis company

Efficiency ratios	Formula	Result	Comment
Passenger per Employee	AP/E	186	human resource efficiency
Employee per Seat	E/FS	0.68	personnel and technology efficiency
Employee per Airplane	E/AF	29	technical level and structure of the fleet
Revenue per Employee	R/E	20660 USD	human resource efficiency
Expenses per Employee	OC/E	25849 USD	human resource efficiency
Revenue per Passenger	R/AP	111 USD	market demand
Revenue per Seat	R/FS	14115 USD	the efficiency of aircraft use
RPKs per Seat	RPKs/FS	0.407	market demand and supply balance
RPKs per Employee	RPKs/E	0.596	quality and cost of human resources
ASKs per Seat	ASKs/FS	0.63	the efficiency of capacity used
ASKs per Employee	ASKs/E	0.916	the ability of demand for supply
Revenue per ASKs	R/ASKs	0.022	rate of return on offer
Expenses per ASKs	OC/ASKs	0.028	operating expense rate

- P-5. Calculate the efficiency ratios (ER) of RC in the same way as the above calculation of CC. The corresponding RC table was omitted.
- P-6. Calculate the numerical values of risks on a 10-point scale. Example: Expenses per ASKs: 0,04 / 0,028 = 1,43. This corresponds to the range of the matrix risk assessment model [1,3–2], points 5, color “yellow”.
- P-7. Summarize calculations in a common table of ER. For a numerical ratio of CC and RC, relative parameters are introduced, which are taken as a unit (Table 16.8):
- P-8. Build charts. Mark the levels of risk (Fig. 16.6).

The method of computing principal components gives the following results: three parameters are in the "green" range, three parameters are in the "yellow" range, and seven parameters are in the "red" range. Conclusion: the state of the CC is critical, both in terms of safety and economics. Recommendations: provide revision of the strategy of business and management of the CC; develop and implement a crisis management plan.

Table 16.8: Calculation of risk states from efficiency ratios

Efficiency ratios	CC		RC		Risk points	Risk color
Passenger per Employee	186	1	2200	11.83	10	red
Employee per Seat	0.68	1	0.35	0.51	2	green
Employee per Airplane	29	1	40	1.38	3	green
Revenue per Employee, USD	20660	1	150000	7.26	8	red
Expenses per Employee, USD	25849	1	46998	1.82	5	yellow
Revenue per Passenger, USD	111	1	120	1.08	1	green
Revenue per Seat, USD	14115	1	100000	7.08	10	red
RPKs per Seat	0.407	1	1.227	3.01	7	red
RPKs per Employee	0.596	1	3.06	5.13	8	red
ASKs per Seat	0.63	1	1.1	1.75	4	yellow
ASKs per Employee	0.916	1	8.1	8.84	10	red
Revenue per ASKs	0.022	1	0.05	2.27	7	red
Expenses per ASKs	0.028	1	0.04	1.43	5	yellow

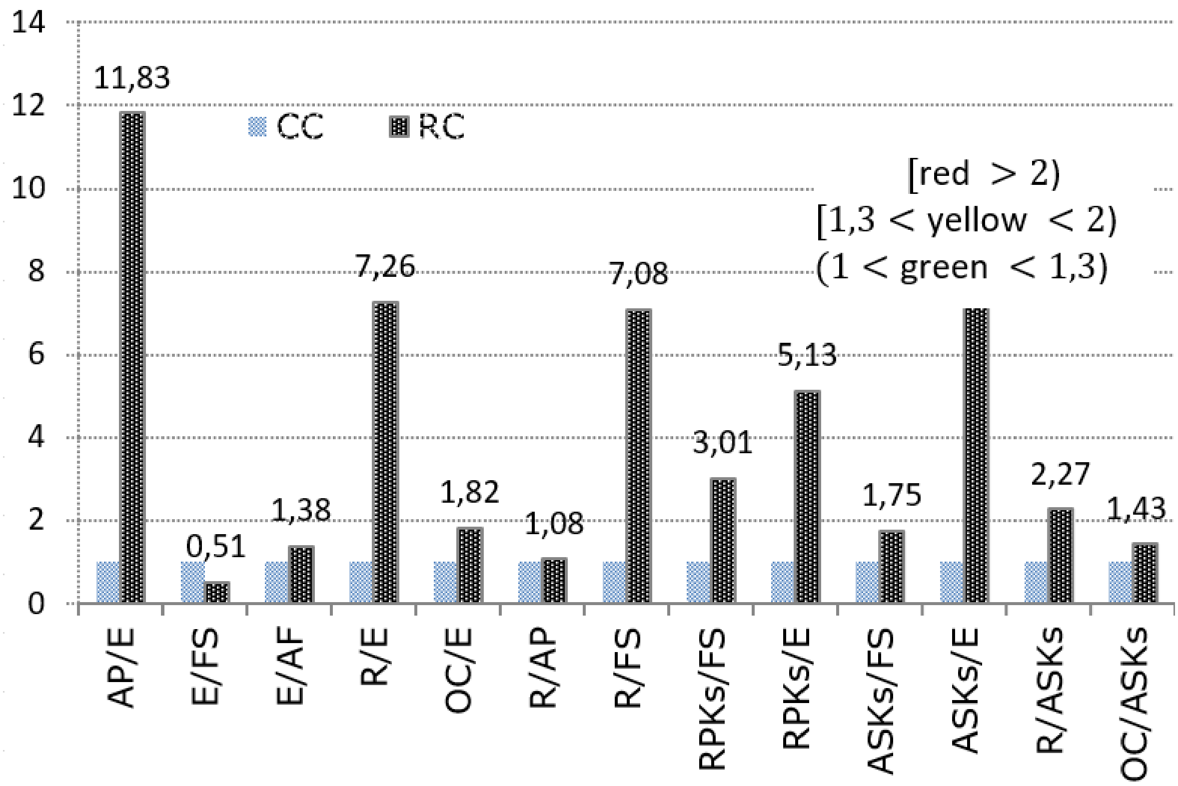

Figure 16.6: Assessment of CC and RC efficiency ratios

16.5 Conclusion

The method is used: a) for continuous company self-assessment and analysis of the state of safety and business performance within the organization; b) for quick expert assessment of the position in the market by external agents; c) to compile integrated ratings of local, regional and international industrial markets; d) to use as analytical data for the development of national transport strategies.

Results. The method of principal components is developed and evidence of its practical implementation is presented through the assessment of states of safety, risks, and effectiveness of the organizational activities. The substantiation of SC of the states of organizations by groups of indicators and parameters is presented. The application of the method allows the use of a minimum number of 10-15 indicators and parameters of the organization's activity. Indicators and parameters are developed separately for different industries. The particular importance is the designing of a reference model as a future image of the organization. The advantage of assessing by groups of indicators is the simplicity of identifying the states of individual resources of the organization. Estimating the state of the organization for each group of indicators has less accuracy, but provides the opportunity to obtain quality estimates in real time for making management decisions. The method is implemented in projects of various industries: IT business, and the sphere of intellectual services of a consulting organization.

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