ADAPTIVE MANAGEMENT PROCEDURAL MODEL FOR SUPPORT OF ECONOMIC ORGANIZATIONS

Marin ANDREICA[1]
Madalina Ecaterina POPESCU[2]
Dragos MICU[3]
Eugen ALBU[4]

ABSTRACT
The paper highlights the concerns of the authors from recent years and it is trying to respond to a series of new things that decision-makers face, under the pressure of the destabilizing factors in our economy. By analyzing the economic environment and its effects in the management plan, the authors propose a procedural model of assistance for adaptive management, for planning the work experienced at a company in the textile industry. Moreover, theoretical aspects are debated, in regards to adaptive and forecasting management, reaching the conclusion that these two concepts complete each other in the context of the frequent turmoil of the economic environment, and one can`t be without the other.

KEYWORDS: *adaptive, forecast management, models, objective function*.

JEL CLASSIFICATION: *C51, C61, D04*

1. INTRODUCTION

With every year, we become increasingly aware that the global economy in general and the economic and social environment in which we operate is increasingly tortuous and building your trajectory of evolution implies accepting uncertainty and risks related to the economic environment. In this context, any prediction will be accompanied by a degree of uncertainty relative to the possibility of achieving assumptions which were the basis for future projection of the path of evolution. This degree of uncertainty will be lower for smaller amounts of time but it is not productive to segment the trajectory on small distances without previously establishing the final destination. Furthermore, there are frequent situations when setting goals on time segments is based on achieving them on the last sequence of the time horizon (from the future to the past) aiming to harmonize the objectives with the resources in the foregoing sequences of which are set, if technical possibilities limit the objectives within the sequence analyzed.
Any disturbance in the evolution of economic processes generated by economic, technical, social and political factors could lead to the reassessment of the future objectives. If no action is taken, then either that potential losses are insignificant, or we are working stock, anticipating that the economic environment will return to its original state (accepting the risk of the degradation for the products and the market not returning to its original state).

[1] Bucharest University of Economic Studies, Romania, marinandreica@gmail.com
[2] Bucharest University of Economic Studies, Romania, National Scientific Research Institute for Labor and Social Protection madalina.andreica@gmail.com
[3] Bucharest University of Economic Studies, Romania, micuvdragos@gmail.com
[4] Bucharest University of Economic Studies, Romania, albu.privat@gmail.com

In order to maintain the identity of firms in such a context, it is necessary to improve the managerial act and its profitable adaptation to new challenges.
In this area, the main trend that manifests in the world at all levels of the organization is to anticipate the future evolution of economic phenomena because they cannot be controlled without their conceptual forward-bringing. Consequently, forecast management of economic organizations has an increasing key role in the management process.
The dynamics of the economic environment in most situations requires the updating of the initial objectives, in consistency with the market and its requirements. This will *adapt* the initial forecast to the new trends of the market. It is possible for this adjustment to be continuous. Naturally, the question arises: how often will these adaptations be made? We know that any change in objectives is reflected in the material and technical basis (performance conditions) and in the structure and volume of material costs. Another question that naturally arises: is it relative to the distractions that generate the adaptability of the forecasts? They are economic (changes in prices of products, market requirements, etc.), social (wage increases, epidemics, strikes, etc.) and legal (tax code change, environmental law, labor law, etc.).
Therefore, the implementation of adaptive management is a sine qua non for the survival of businesses, namely to preserve their identity.
Drawing a parallel between the concepts of adaptive system and adaptive management, we find that they interfere mostly in technical systems` theory and less in the economic field. Technological process requires to be completed in at least two stages (Byron et al., 2007).

- building the mathematical model of a dynamic system capable to analyze and describe the process behavior and
- driving the implementation of a process computer and making its interface with real technological process.

As shown, the second stage, which, incidentally, is the essence of systems theory, handles abstract objects offering mathematical models as the solutions.
The logic underlying the concept of an *adaptive system* is based on the realization that the management system requires *construction and operating information*. The adaptive attribute can be attached if it is capable of achieving the management`s objectives with building information that was initially incomplete. An adaptive system must automatically fill in the information about the original construction process in real time using operating information to identify the real online process.
Economic systems are "coupled" to the market and encounter sometimes unpredictable evolutions from the moment of their development. Therefore, with the development trajectories of evolution patterns we must define the parameters that will allow adaptation to "coupling" and the rules for conducting the adaptation (Andreica et al., 2007; Andreica, 2013).
The vulnerability of the predictions can be tested by analyzing the stability and sensitivity of their trajectories, if the trajectory evolution models are for optimization.

2. ADAPTIVE MANAGEMENT PROBLEMS

Any adaptation of forecasts is preceded by stability analysis and analysis of the adaptation opportunities to the evolving business environment. As shown above, the forecasts are developed on the timelines in which it is difficult to estimate the evolution of disturbances. Without taking them into account, they might remain inert and ineffective in terms of organizational management.
Acknowledging the need to adapt them we find that the adjustment process can affect both the initial objectives and material basis. Problems relating to the effectiveness of adaptation emerge: how much is lost while maintaining the initial objectives and material basis, if adaptation is partial or total.

Any change in goals requires decision preservation or recovery of those already made and the investment needed to develop the material basis needed for new targets. Then comes into the picture the time required for adaptation and the financial resources for this process. And finally, there is the possible frequency of the changes.

In particular, however, we are interested in which is the acceptable frequency of changes, so as not to affect their efficient implementation. Basically, adaptation is a reaction to the random changes in the economic environment. Like the forces in physics, opposite reactions occur in the economical field, like the inertia of the system. Objectives that remain after adaptation will be the inertial forecasts.

Essentially, the following situations may occur:

- Stable structure predictions, if the adjustment does not change the objectives and material basis. We encounter such situations when substantiating forecasts are made taking into account the maximum levels of consumer regulations but the stability obtained will lead to additional expenses with the resources and their waste.
- Predictions with absolute inertial structure, if the objectives and material resources are shrinking but no new ones are introduced.
- Fully adaptable structure forecasts, if all the initial objectives are abandoned, as well as the initial material basis. Basically there is a restoration of the economic process.

In practice, it is recommended that the process of adaptation of the forecasts objectives is not affected in proportions greater than 10-20% of the originals, because it is very difficult to achieve the material basis alteration in the remaining time horizon. Moreover, the process of adaptation is always restricted by difficulty in preparing the material basis. That`s why in economic organizations with large manufacturing cycle the inertia is much higher.

Ideally, in terms of adaptation efficiency, it would be like the change of additional expenditure forecast update, or losses due to not changing them to be recovered by the new model of forecasting performance.

3. PROCEDURAL ASSISTANCE MODEL FOR ADAPTIVE MANAGEMENT

Procedural assistance model for adaptive management must contain forecasting and planning modules. They facilitate decision making regarding the development of organizations on medium and large time horizons, harmonization of the forecast objectives with the resources for smaller horizons of time - usually a year or quarter. Basically, procedural models are made in a system aimed at assisting management models predicting economic organizations. The authors carried out such an approach in designing an interactive system to assist adaptive management models that are presented in the paper “Modern Approaches of Provisional Management in Economic Organizations” (Andreica et al., 2016).

Below we will develop the planning module, highlighting the main conclusions that were drawn from his experience in an industrial organization. These are the main characteristics of procedural assistance adaptive management of planning:

The working hypothesis from which we started is that the production process allows the modeling for the production structure plan using linear programming. This means that the multitude of admissible solutions is bounded, non-empty and convex.

1. The specific consumption of resources and objective functions coefficients are constant over the time period (if the application is made in a month);
2. The restriction classes taken into account are resource (material, human, technical) and objective classes (planned quantities, contracted quantities). It is possible the extension of material, human and technical classes, functional correlation classes and/or structural between economic indexes, financial resources restrictions, etc.;

3. There is the possibility of supplementing the resources or reducing some targets if there are system incompatibility restrictions;
4. Forecasting module interface is achieved through the forecast level of indicators that are included in the restrictions of goals (Andreica et al., 1998; Stoica et al, 2006; Andreica et al., 2014);
5. Forecasting module interface is achieved through the fuzzy optimizing procedures with vague restrictions (Zadeh, 1975; Andreica, 1988; Andreica, 2011; Andreica et al., 2011).

The model procedures are**:**

Preparatory phase of the plan

P1. It generates the plan optimization model with tolerances associated to all restrictions and the objective function to minimize their amount (1). The coefficients of the variables in the objective function are unitary.

The resulting solution will show the compatibility of the equation if the value of the objective function will be zero or its incompatibility otherwise. Tolerance values other than zero indicate the necessary additional resources or values that should be mitigated the objectives for the system to be compatible (t_{1i}^{*}, t_{2i}^{*}).

$$\begin{cases} [min] \quad \sum_{i=1}^{m} v_i t_i \\ \sum_{j=1}^{n} r_{1ij} x_j \le d_{1i} + t_{1i}, \; i = \overline{1,z}, \; j = \overline{1,n} \\ \sum_{j=1}^{n} r_{2ij} x_j \ge d_{2i} - t_{2i}, \; i = \overline{z+1,m} \end{cases} \qquad (1)$$

Where:

v_i – penalty coefficients for tolerance variables;

x_j - planned quantities for the ***j*** product;

r_{1ij}^{l} - units of consumptions for product ***i*** for making the ***j*** product;

r_{2ij} - uniform rate of objective variables restrictions;

d_{1i} - the available amount of the ***i*** product;

d_{2i} - ***i*** plan objectives.

P2. The free terms of the equation system are modified with the values of the tolerance variables from P1 and solve the optimization model with the initial objective function (minimum or maximum) that can have one or multiple criteria's. The optimal solution will highlight the updated objectives for the remaining time until the end of the initial forecast time period.

$$\begin{cases} [opt] \ \sum_{j=1}^{n} p_j x_j \\ \sum_{j=1}^{n} r_{1ij} x_j \le d_{1i} + t_{1i}^*, \ i = \overline{1,z}, \ j = \overline{1,n} \\ \sum_{j=1}^{n} r_{2ij} x_j \ge d_{2i} - t_{2i}^*, \ i = \overline{z+1,m} \end{cases} \quad (2)$$

Where:

p_j - variables in the objective function coefficients

t_{1i}^*, t_{2i}^* -optimal tolerances from P1 associated to the free terms

The optimal plan (x_j^*) will correspond to the smallest tolerances associated with the resource restrictions for those targets.

P3. Validates the results. If the extra demand for a resource is impossible to achieve, the model from the P1 procedure is taken back into account and we introduce the penalty coefficients for tolerances associated to restrictions of that resource. Then we can proceed with P2 procedure.

If the objectives cannot be reduced by the amounts resulting from model, perform the same operations as described above for resources. In this case, it will get maximum additional resource needed to deliver the plan.

If resources cannot be supplemented within the model results, it will seek a compromise solution to the simultaneous easing of restrictions both of the objectives and the growth of the objective function coefficients penalty for those who have a limited tolerance. Conducting the optimization process towards the easily achieved goals or easy to get resources is made using the penalty coefficients that will be of great tolerance for other variables.

The adapting phase of the plan for T1

A) The manufacturing classification structure is not changed

The used procedures will be:

A1. The initial resource availability is dismissed with the quantity used until T1 (for those materials), the remaining time is recalculated for the production capacities and human resources, and the final objectives are diminished with the ones already finished.

Possible changes:

-modifying the initially considered amount of available resources

-modifying the objectives for the remaining period of time (waiving or modifying some initially considered values)

-changing the resources consumption or the coefficient of the objective function, namely the restriction of resources

Restoring the structure of the plan for the remaining time period (T) means going back with the P1 and P2 procedures with the change made for the parameters affected by the economic environment's evolution.

A2. Partial amendment of the manufacturing nomenclature

The used procedures are:

The resumption of the optimization cycle (P1, P2) if the model variables will change, the free terms (idem A1), and the coefficients for some variables from the objective or from the restriction function.

A3. Changing the entire manufacturing nomenclature

The procedures used are the same as the ones from the plan elaboration phase, but the time period will be [T1, T].

Adaptive management procedural model was tested in a company in the clothing industry for one quarter of the year, aiming to maximize profits. Simulated scenarios were aimed to possible adjustments to the original plan.

Below are the simulated scenarios:

- First scenario

We have seeker the ideal structure for the plan through solving the model (2) only with available resources restrictions (no objective restrictions) and without the tolerance association. The result highlights the equation system`s compatibility as well as an ideal level for the profit, we only used a few products (the most profitable ones).

- Second scenario

We added product restrictions to the first scenario (not going above the ordered quantities).

The result highlighted the system`s incompatibility. Tolerances have been added to the resource restrictions and the new equation system has been solved using the objective minimization function for the total amount of tolerances only for the ordered quantities, resulting in the need to increase the production capacity.

- Third scenario

We have maintained the conditions from the second scenario, but we only diminish the resource restrictions. By solving the model with the objective minimization function for the total amount of tolerances, the necessity for increasing the available resources came up.

Basically, through the experiment carried out, the decision makers were informed of the resource deficits and surpluses or narrow places of the manufacturing process.

In addition, they were instructed on how to use the model to adapt the original plan in case of any disturbance.

As a result of the large share of wage costs in production volume, the resulting need for restructuring indirectly productive employees in parallel with the skills of its existing staff.

4. CONCLUSIONS

The objectives` harmonization with the resources of a small or medium business organization in the context of an increase in economic development factors and the restrictive nature of some of them must be carried out with the emergence of any disturbance. In addition, dynamic disturbances and foreign financial crisis lead policy makers to reconsider action strategies, to adapt to the prepared economic forecasts (Andreica, 2009; Andreica & Andreica, 2014; Andreica et al., 2009).

Finally, we point out that adaptive and forecast management are not antagonistic. On the contrary, they complement each other in an economy with such common turbulences, so they are inconceivable without each other.

In the context of economic instability it is necessary to have a cautious adaptive management forecast because of the risk of squandering resources allocated to achieve objectives without the market and the bankruptcy.

Consequently, the decision makers must have at any time evolving alternative strategies for the various hypotheses of evolution of the economy and the scientific instruments for them.

REFERENCES

Andreica, C., Andreica, M., Andreica, R., Miclăuş, I. & Ungureanu, M. (2007). Conclusions on Using the Statistical Methods in Forecasting the Structure Evolution of an Economic Indicator System. *Economic Computation and Economic Cybernetics Studies and Research*, *1* (2), 147–157.

Andreica, M., Andreica, C. & Micu, D. (2016). *Abordări moderne ale managementului previzional*. Bucharest: Editura ASE.

Andreica, M., Andreica, C. & Micu, D. (2014). Foresight management support system for SMEs, *Proceedings of the International Conference „Sustainable development in the economic instability conditions”*, 3rd Edition, Cybernetics MC Publishing House, Bucharest, 23-27.

Andreica, M. E. & Andreica, M. (2014). Forecast of Romanian industry employment using simulation and panel data models. *Romanian Journal of Economic Forecasting, 17*, (2), 130-140.

Andreica, M. E. (2013). Early warning models of financial distress: Case study of the Romanian firms listed on RASDAQ. *Theoretical and Applied Economics*, *10*, 5 / 582, 4-12.

Andreica, M. (2011). *Previziune microeconomică*, Bucharest: Editura Cibernetica MC, Ediția a doua.

Andreica, M., Partachi, I., Andreica C. & Andreica, R. (2011) *Previziunea în afaceri.* Chisinău: Editura ASEM, Bucharest: Editura Cibernetica MC.

Andreica, M., Nicolae, D. & Andreica, M. E. (2009). Working out forecasts on the Basis of Statistical Extrapolation Principle. *Economic Computation and Economic Cybernetics Studies and Research, 43*, (2). 85-108.

Andreica, M. E. (2009). *Predicting Romanian financial distressed companies, advances in economic and financial research*. DOFIN Working Paper Series 37, Bucharest University of Economics, Centre for Advanced Research in Finance and Banking, CARFIB.

Andreica, M., Stoica, M. & Luban, F. (1998). *Metode cantitative în management*. Bucharest: Editura Economică.

Andreica, M. (1988). *Metode şi modele de planificare*. Bucharest: Editura Ştiinţifică şi Enciclopedică.

Byron, W. K., Szaro, R. C. & Shapiro, C. D. (2007). *Adaptive Management: The U.S. Department of the Interior Technical Guide*. US Department of the Interior.

Stoica, M., Andreica, M., Nicolae, D. & Cantău, D. (2006). *Metode şi modele de previziune economică.* Bucharest: Editura Universitară.

Zadeh, L. A. (1975). *Fuzzy Logic and Aproximate Reassonning*, Synthese, vol.30.