COMPUTER AIDED SWOT ANALYSIS APPLIED TO SMES USING CONCENTRATED ENERGIES TECHNOLOGIES

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ABSTRACT: The paper deals with several variants of SWOT analyses, including qualitative and quantitative types and combination between these types. An efficient predominant quantitative computer aided variant is applied to some Romanian SMEs, involved in research activities, working with concentrated energies technologies, respectively, electrodischarge machining, laser beam machining and ion / electron beam machining. Some strategic diagnostics and strategies to be followed by the SMEs resulted from the proposed variant of SWOT analysis.

KEY WORDS: SWOT, computer aided, SMEs, concentrated energies.

1. INTRODUCTION

A well known managerial instrument, very often used in the process of strategic management is the SWOT analysis. In 1982 Heinz Weihrich from University of San Francisco introduced this method in its classical form (Weihrich, 1982). There are some other authors who claimed this method in other different forms. The initials of the four issues, Strengths, Weaknesses, Opportunities, and Threats gave the name of the method. Heinz Weihrich initially called this method TOWS. The instrument is based on the evaluation of these four items and it is finalized through a strategic diagnostic and an appropriate strategy. It has to be emphasized that SWOT analysis connects internal and external evaluation. The Strengths and Weaknesses are understood as internal factors, which could be controllable, and can be acted upon. The Opportunities and Threats are seen as external, independent and uncontrollable factors.

2. VARIANTS OF SWOT ANALYSIS

There are two types of methods generally applicable: qualitative and quantitative one. A more detailed review of these variants is presented in (Ghiculescu, 2010).

The qualitative approach supposes the combination of all S, W, O, T issues, which are identified using four corresponding lists in order to generate all possible strategies framed in SO, ST, WO and WT types (Weihrich, 1982). A large consume of resources is needed to formulate all these strategies.

A more efficient variant is the quantitative method recommended in (Wheelen & Hunger, 2007). The most efficient approach uses only two lists: one for internal and one for external analysis. To each element, a weight (depending on its importance) and a sign (plus or minus) are allocated; the sign indicates the element placement within the category S or W, respectively O or T. In order to control the weights assignment, their sum has to be 1 if values under 1 are used or 100% if percentage values are used. To reach the appropriate strategy, a graph of four quadrants is drawn. A quadrant is assigned to each type of strategy. Then a weighted sum for each couple of variables, strengths / weaknesses and opportunities / threats, is effectuated, which leads to a position in one of the four quadrant of coordinates S-W, O-T.

The evolution of SWOT analysis has been focused on growing the accuracy of its results, aiming at amelioration of its inevitable subjective character. In this sense, in 1995 G. Garibaldi introduced a new method, more analytical, the so-called New SWOT Matrix (Garibaldi, 2001). The novelty of this method relies on ranking of opportunities and threats depending on their different importance. The two factors used in ranking these issues are the probability of their occurrence and the effect on the organisation performances. Consequently, instead of four generic strategies as in classic method, six specific strategies are issued, by combination of the three situations depending on ratio between
opportunities and threats and two situations conditional on ratio between strengths and weaknesses. These generic strategies are: (1) the game of win chances; (2) the game of high risk chances; (3) the paradise; (4) the inferno; (5) the purgatory; (6) the dilemma. Every different strategy has its particular recommendations to be applied.

Several variants of computer aided SWOT analysis emerged nowadays. One of the most interesting is the Cymeon SWOT Standard (Cymeon, 2010). This instrument has some similarities with the New SWOT Matrix in terms of probability of phenomena occurrence, affecting the organisations competitive position. Therefore the dynamics of environment evolution is grasped, using three time stages: current, short and long term. This approach categorizes the issues into those that organisation will have to handle at present, in the next future and in the long term. Each SWOT issue is evaluated through its competitive impact and multiplied by probability of emergence. Thus its importance is determined.

The sum of the importance coefficient for each of the four types of issue is calculated, i.e. Strengths = Sum (Probability x Impact) for all the issues corresponding to that time frame. The point position on the graph is determined by the difference between the sum of the importance coefficients for strengths minus weaknesses (the ‘y’ coordinate) and the sum of the coefficients for opportunities minus threats (the ‘x’ coordinate). The analysis indicates a possible type of strategy to be applied, providing information, e.g. the opportunities will be exploited in the short-term, but overall the organisation will be in a position of weaknesses in the longer term if it does not become accustomed to environmental challenges.

In order to visualize dynamically the competitive position of organisation in SWOT coordinates, the weights of probability and impact can be modified. Hence the variation of probability from 0 to 100%, displays the least and the most probable scenario in a dynamic way. It also can be shown the evolution of plotted point during the analyzed time interval.

Another important characteristic of SWOT is that the analysis must be achieved in relation to competition. Even if a competency is considered to be high, but is lower than the competitor’s one, this issue belongs to weaknesses not to strengths. From this, it results the relative character of SWOT analysis. If the organisation improves its position comparing to that provided by SWOT analysis, it is considered that it has proactive policy orientation. On the contrary, if it will have a worst position in the future than that indicated by SWOT, it has rather an inactive policy. The policy frames the organization strategy.

There are some usual pattern elements to be addressed during SWOT analysis, configuring a sort of check list. These issues to be analyzed are resources, capabilities and distinctive competencies leading to sustainable competitive advantage for S, poor elements from Internal Value Chain Analysis for W or competencies related to People, Resources, Innovation & Ideas, Marketing, Operations, Finance or Critical Success Factors and Political, Economic, Social, Technological, Legal and Environmental factors or issues from Porter’s model of the Five Forces for O and T (Porter, 2001).

SWOT analysis is effective, having an important effect. Yet it requires significant resources to be spent. It is more effective when is approached as a team activity with people from diverse backgrounds and expertise. This is a similar phenomenon to that obtained during brainstorming as a result of synergetic effect. Due to increasing complexity of actual organizational processes, computer aiding analysis becomes a strong managerial tool to be used nowadays.

Apart from its broader organisational application, SWOT analysis was also developed in personal area for individuals, bearing in mind the importance of human resources in organisation performances (Buhler, 1997).

3. COMPUTER AIDED VARIANT OF SWOT ANALYSIS

A SWOT analysis aided by computer is achieved, and applied on three Romanian SMEs, users of concentrated energy technologies. The three organisations use electrodischarge machining (EDM), laser beam machining (LBM), and respectively electron and ion beam machining (EBM&IBM).

The applied instrument is in fact a mix between qualitative and quantitative version previously presented. Hence, four lists of analyzed issues are elaborated, matching each S, W, O, T category. These four such lists (fig. 1) are based on standard issues (Porter, 2001) and up-dated by technical and economical information related to analyzed organizations.

On this basis, the studied entity can be framed in a coordinate system with variables S-W, O-T, depending on the level of each variable (see the fig. 2).
This approach efficiently leads to a type of strategy, specific to one of the four frames:

**S-O Strategies (S>W, O>T)** combines the most favourable elements S from internal analysis and O from external one to create a strong competitive advantage – aggressive strategies;

**S-T Strategies (S>W, O<T)** are based on strengths of organisation to avoid or reduce the threats from external medium; these could be defending strategies but they could be transformed in attack strategies if a correct evaluation of internal and external forces ratio is achieved, efficiently exploiting the strengths of organisation;

**W-T Strategies (S<W, O<T)** aim at minimizing the weaknesses under conditions of a hostile external environment; these are defending strategies used when organisation is in decline;

**W-O Strategies (S<W, O>T)** combines the weaknesses elements of organisation with opportunities from external environment, trying to exploit the opportunities using competencies (strengths) acquired through strategic alliances.

The transition from generic strategy to real elaboration (formulation) of each strategy is the subject of second stage of strategic management process, based on factual S, W, O, T elements previously identified. This is an obvious qualitative approach.

In order to establish the coordinate position \((x, y)\) of analyzed organization within one of the four quadrants, the following formula is used:

\[
(x, y) = \left( \sum_{i=1}^{m} s_i - \sum_{j=1}^{n} w_j, \sum_{k=1}^{p} o_k - \sum_{l=1}^{q} t_l \right)
\]

where: \(s\) is a certain strength; \(w\) - a certain weakness; \(o\) - an opportunity; \(t\) - a threat; \(m\) – number of strengths; \(n\) - number of opportunities; \(p\) - number of opportunities; \(q\) - number of threats.

The \((x, y)\) coordinates lead to one of the four generic strategies as it is presented in fig. 2.

Analyzing the issues according to the check list (Ghiculescu, 2007), the following items are identified in case of the three SMEs:

- **SME no.1, EDM user:**
  - \(S\) (m=12) – high qualified staff long experience in EDM area and other concentrated energies technologies; distinctive competency – one of the few experienced on EDM generator; favourable appreciation of clients – leader of service market in EDM; strategy based on environmental analysis; patents owner leading to sustainable competitive advantage; low costs operations – very few employees; new created products and technologies; high quality of products; technological potential – patents related to shape of EDM pulses; expertise in EDM field; organizational culture appropriate to strategy, based on USA management experience.
  - \(W\) (n=4) – low financial capacity; focusing on current problems against future ones; internal operational problems; poor quality of marketing.

- **SME no. 2, LBM user:**
  - \(S\) (m=13) – high qualified staff, long experience in LBM area and other concentrated energies technologies related to optical field; distinctive competency in applying LBM to new materials with optical properties; favourable appreciation of clients in optical area; strategies oriented to the new trends in the field; several patents resulted from the intensive research activities; low costs due to an austere using of the available resources; capacity to create new products and technologies; long experience in LBM field; management quality and organizational culture oriented to flexibility needed to research projects management.
  - \(W\) (n=3) – some fails in research activities; insufficient network distribution; poor quality of marketing.

- **SME no. 3, EBM and IBM user:**
  - \(S\) (m=9) – high qualified staff in EBM and IBM field; sufficient financial resources for actual challenges;
distinctive competencies in above mentioned area based on innovative capacity for new products and technologies; patents owner that could lead to sustainable competitive advantage; expertise and technological potential; high speed reaction to environment changes. W (n=3) – same weaknesses as in previous case.

External analysis has many similarities in case of EDM, LBM, EBM-IBM technologies markets as it is presented below: O – possibilities to enhance the products range and complementary products for all analyzed technologies; possibilities to achieve strategic alliances and favourable agreements in case of LBM, EBM-IBM. Thus it resulted p=2 for EDM market and p=4 for LBM and EBM-IBM. T - low rate of Romanian market development; disadvantageous modifications of exchange course; regulation measures with negative impact (e.g. VAT increase, 25% decrease of salaries etc.); national economic crisis; global economic crisis; change of customers needs; increase of negotiation power of providers and clients; demography changes; ecological pressures for EDM market; global events. Hence the results are: q=11 for EDM and q=10 for LBM and EBM-IBM.

As one can see from fig. 3, all three SMEs are framed in quadrant S-T Strategies (S>W, O<T), belonging to defending / attack strategies, meaning searching for more favourable environment, using prevailing strengths. Specific strategies could be developed by each studied organizations.

The SME no.1- EDM user has the option to achieve strategic alliances and favourable agreements based on its distinctive competencies and high expertise in EDM generators. Cooperation with research units is recommended aiming at increase of financial sources by research projects from budget funds.

The SME no.2 - LBM user is better positioned than the other two. Nevertheless, its position could be improved by penetrating external markets, which are more attractive.

The SME no.3, - EBM & IBM user could improve is marketing mix in order to take advantage of its patents in nanotechnologies field and high level of technological potential.

4. CONCLUSIONS AND INTENTIONS

All the three analyzed SMEs are characterized by high level of competencies which allow them to play an important part in research projects. Their innovation potential, including the managerial one in Schumpeter’s sense, is the way to penetrate more attractive environment, exploiting opportunities by prevailing strengths.

A more accurate SWOT analysis is intended to be developed in connection with other managerial instruments for external and internal analyses as customer matrix and producer matrix.

5. ACKNOWLEDGEMENTS


6. SELECTIVE REFERENCES

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