TECHNOLOGY AUDIT – GENERAL AND PRACTICAL LINES

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ABSTRACT. The present paper is a mixture between the theoretical notions regarding the procedure of technology audit (TA) and the experience the authors have gained from actually applying it on SMEs, so that the provided viewpoint shall be a realistic one. It starts with a general presentation of the technology audit process (TA), its main parts and subdivisions, emphasizing the role and importance of each single one. There are detailed descriptions of the benefits recurring from performing a TA, as well as the implication of the analyzed company in these activities. We have considered useful to resume the process into a graphic representation, showing the interconnection between all the parts of a TA, as well as their order. At the end, one has mentioned the action plan, the component of the TA that provides specific solutions for the deficiencies determined with the help of a SWOT analysis. Last but not least, extending the procedure to macro level, one has presented some of TAs general utilities and impacts, correlated with the cooperation with the local and central authorities.

Key words: SMEs, Technology Audit, SWOT, Action Plan.

JEL Classification: A12, L26, M49, L29

The actual worldwide economic context forces SMEs to adopt measures to enrich resistance to potential waves due to new arrangements of the involved actors - clients, suppliers, competitors, the state and government institutions.

Since the SMEs are the providers for two thirds of the existing working places, in Romania there is a permanent search for solutions in order to sustain them in becoming or maintaining competitive, by intensifying the contacts between Government, social partners, National Bank and other factors (innovation and technological transfer network) that can contribute for defining a coherent politic for the field.

Competitiveness is a complex concept which, at a general level, expresses the ability of persons, companies, economies, regions to maintain competition on internal and / or especially international scale, and to get economic benefits, in terms of a specific business environment, resulting in constant increases in productivity and standard of living.

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There are many factors that influence competitiveness, such as: material base, financial means, market information, skilled and competent staff, creative potential of human resources and expertise level of the company. Still, when you ask a manager about his business and the influencing factors, not many seem to realize that, somehow, not mentioning or diminishing the role of innovation, they leave out the most important instrument of development for their company.

Whether we are talking about developing new products or services or identification of the most efficient already existing methods of accomplishment, innovation brings added value to an organization. In the same time, it allows to maintain or improve their market share.

Since innovation does not have the proper quotation in the life of a potential competitive company, we have decided to emphasize its importance and the way it can be evaluated and further sustained.

In the same time, we need to correlate innovation with the other factors that have strong impact on companies’ good development.

The assessment of manufacturing and service SMEs with a technology platform is accomplished through a technology audit (TA), which is in fact a method for identifying the major company requirements, needs, weaknesses and strengths on both human resources and infrastructure. At the same time, the TA is a technique, which identifies the management’s view of how the company performs as well as strong indications of what the company really needs. By accomplishing a TA, one can have a real view over the external and internal environment of the company and, simultaneously, identify the human resources relation to company’s performance. The main objective of TA is to provide a clear identification of company’s first priority needs as well as strengths and opportunities that should be taken under consideration.

The SMEs suited for performing a TA should wish to create new products, incorporate new processes, diversify their activities and be with growth potential. Moreover, the SMEs should however have the capacity and ability to survive and innovate, and also have a strong will for international cooperation.

An SME can perform a TA in order to:
- generate income (or more income) for the technology driven organizations (e.g. technology based enterprises, research centers, institutes) from their available technology;
- improve the productivity of the technological factors;
- improve business competitiveness;
- learn how to optimize the use of current technology;
- learn about company technology options;
- check the technological status against technological criteria and to issue recommendations.
The benefits for the SME are obvious. Thus, a TA will produce an action plan that, after being applied, will generally lead to improved performance of the company. At the same time, it is important to mention that performing a TA does not necessarily imply success for the company. In fact, TA is a tool simply providing a structure within which a company is more likely to improve its potential.

There are some other assessment methods, approaching in a way to the objectives of a TA, but still different in their essences. Among them, one can mention:

- The innovation management audit. In this case, the SME auditing and analysis is performed with the aim of providing action plans concerning mainly management issues (e.g. strategic planning, HR development, marketing etc.)
- The self-evaluation audit, which is a method performed in-house, providing the SME’s relevant existing mechanisms.
- The benchmarking exercise mainly consists of a thorough analysis, made on certain criteria, in order to evaluate and compare the considered SME with other leading or average companies existing in the same activity sector.
- The company visit. This is a method of getting in touch with SMEs, used mainly for identifying local RTD needs and/or offers.

Still, many of unauthorized people confuse the technology audit with the company visit. Comparing the two mentioned ones, the technology audit is far more detailed and time consuming than the company visit. In a further separate chapter, this paper will present the complex structure of a TA. Last but not least, the TA mainly aims at delivering recommendations that could benefit the client.

At the same time, a TA should not be undertaken without first completing a company visit. During the company visit, the auditor will collect the first information on the SME, pin-pointing topics for a further examination and discussion. The information related to the activities carried out in the company will show if the SME really needs a TA. As it was already mentioned, only the manufacturing and service SMEs, with a technology platform, are suitable to performing a TA. In this respect, the information collected during the company visit will give some focus to the future TA.

**Structure of a Technology Audit**

From the beginning, one can mention that there is not a universal, fixed structure of a TA. Still, there are some general stages, valid for each TA (Fig.1)

**Pre-Audit phase**

The starting point of the technology audit process is the desire of a SME to carry out a TA. In this respect, the SME manager contacts an authorized company/person for performing TAs. At this stage, after signing an agreement, the auditors designed for performing the TA start their *preparatory work*, gathering information about the SME taken from its official website, published and unpublished reports. Then, the
Auditors make a company visit, in order to have primary discussions with the manager or different representatives of its boarding staff and to explain and agree on the purpose of the audit and to select the employees to be interviewed. On the basis of this company visit, the auditors will assess the opportunity of making a TA at the involved SME – the pre-audit assessment.

The Technology Audit Tool

The TA itself consists of two parts: the questionnaire and the TA report. In this stage, the SME (its representatives that take part in TA) is being interviewed on the basis of a questionnaire, made by the audit company. The information gathered along the questionnaire will help the auditors to prepare the TA report.

The questionnaire generally comprises the following sections:

Organizational chart and human resources

For identifying the decision makers, the auditors ask questions about the organizational structure of the SME, viewing in this sense its organigramme. Concerning the human resources, the asked questions focus on:

a) the staff number and its trend throughout the last years, for emphasizing the growth potential and investment in human capital (e.g. material and non-material compensations for excellence);

b) its distribution to the various (technology related) departments / compartments. The auditors will check if the SME has a separate R&D department, relevant for the innovative character of the company;

c) expertise and education. The questions should here refer to the number of superior degree employees in the activity field of the SME, the personnel structure on age levels and their expertise in the professional field. The information referring to the preoccupations of the company for improving the professional level of its employees, mainly through external or internal trainings and, at the same time, how each employee understands to enhance his/her professional knowledge.

Products and markets

The TA questionnaire should contain relevant questions concerning the developed products or product series and their share in the company’s turnover, in order to examine the new product development capacity and flexibility of the audited SME.

The distribution chain, especially major clients and suppliers represent another issue that should be considered in the TA questionnaire, for assessing the vulnerability, flexibility and extroversion on the market of the company. Information concerning SMEs with similar activities existing in the region could be useful for drawing a map representing the market position/share and competitors of the company.
**Production and packaging**

This chapter of the TA will take into consideration the following issues existing in the company:

- Production capacity and machine idle times;
- Increase/decrease of product volume and production capacity in the last years;
- Production model used (e.g. batch, continuous flow, etc);
- Automation level (e.g. manual, semi-automatic, fully automatic);
- Standards of the equipment used (e.g. acquisition time, average renewal time, etc).

**Quality control**

During the TA accomplishment, the auditors will examine the certifications and audit mechanisms available in the company, for identifying its sensitivity to quality assurance and the existence of self-audit / internal audit tools and mechanisms.

One will consider again the standards of the equipments used on the technological lines, this time for assessing the importance given to the processes developed in the company and their framing into the technological and quality requirements.

This part is also important, since most of the time it represents, together with the already recognized quality of products/services, a “card” for the company, a guaranty for business excellence.

It is well known that contractors require, as a compulsory element for auctions, recognized quality certificates in the specific field.

**Research and technology level**

Considered as the core of the TA, the research activity carried out by a company and the level of the technology applied in the industrial processes offer a real overview upon the innovation degree of the audited company.

Analyzing the R&D infrastructure, the company management will be asked about the size of the research department (number of employees, reported to the total number of staff) and the current developed research fields and types.

In order to emphasize the importance given to research, the auditors will ask questions concerning the annual R&D expenditure, expressed as percentages of company’s turnover and the planning for future investments in R&D.
Of course, a company is not able to rely only on its proper research, because it is expensive and not always the results obtained are those really expected. That is why a company which has in its structure a research department should cooperate with other R&D providers, such as research institutes, universities and other SMEs that develop research activity.

Through various national and international programs, the Romanian SMEs are encouraged to participate in R&D projects, for acquiring latest professional knowledge, increasing their potential for new products and services or solving their technological problems. In this sense, information concerning the participation of the audited company in R&D projects will be helpful.
The audited technology based company has a technology portfolio, which includes innovative technologies and know-how, developed by the research department of the company.

It is very important if they are protected, using Intellectual Property Rights such as patents or trademarks (for the developed products).

One will also consider if the company has the appropriate means for transferring own technologies / technological know-how to other SMEs or for importing technologies from other entities, for covering the company’s technological needs. If the answer is positive and the company has already developed technology transfers, the auditors will discuss with the company representatives about the difficulties encountered during the transfer processes.

**Marketing policy**

The marketing policy reflects the view of the company concerning the evolution of its activity, its guiding options, principles and norms, as well its actions for ensuring the valorification of its potential, according to the market requirements. It can be expressed through a unitary and coherent ensemble of strategies, tactics and specific action programs, which ensure both its vision for a certain period of time and the transposition into practice of its defining orientations, options and elements.

The marketing policy is a must for each company willing to promptly and realistically receive the market signals and to rapidly adapt to the changes appeared on the market. Thus, the company is able to correctly assess the market parameters and to allocate its resources according to the real requirements and, at the same time, to recourse the uncovered market segments and its advantages towards its competitors.

Through his ability, the manager of the company selects a restrained number of limited strategic possibilities, which can be delimited as function of the two dimensions of the vectorial matrix of developments, elaborated by Igor Ansoff:
- mission or markets (public or request);
- technology or product (companies or offers).

This bi-dimensional model has in view the present (actuality) and the novelty, which lead to 4 competitive alternatives or basic possibilities:
1. *market penetration* can be achieved only if encourages the clients to consume more or it will attract its potential or other’s clients, due to the offered advantages, such as: price, availability, post-sale services etc.;
2. *product development* as function of the clients’ preferences;
3. *market development* in the conditions in which it maintains the same technologies, will attract new clients by penetrating new spatial markets and discovering new utilities for the existing product;
4. *diversification* which resembles the bypass or innovation strategy, a high risk option.
The merit of Ansoff’s matrix is to present, in a simple way, a complex process, which offers the possibility to formulate strategies, starting from the essential elements (Fig. 2).

<table>
<thead>
<tr>
<th>Product \ Mission</th>
<th>Present (actuality)</th>
<th>Novelty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present (actuality)</td>
<td>Market penetration</td>
<td>Product development</td>
</tr>
<tr>
<td>Novelty</td>
<td>Market development</td>
<td>Diversification</td>
</tr>
</tbody>
</table>

Fig 2. Vectorial matrix of development (Ansoff, 1968)

Nevertheless, in choosing a very efficient strategy variant, the manager should consider the difficulties determined by: change rhythm, processual tackling, market maturity, clients’ technical knowledge and power, enterprise internationalization etc. and adopt a sliding strategy system in order to properly align to every single request/change of the market. This is a very useful technique that allows the company to limit the assumed or unknown risks towards the economic market process.

The auditors will take into consideration the sales and marketing procedures of the company, such as:

- **Sales:**
  - Type: direct, through commissioners or on-line sales type;
  - Policy: bonuses, discounts, raffles.

- **Publicity:** for the company or for a specific product:
  - Own website;
  - Fliers and brochures presenting the products / services / technologies of the company;
  - New products launching events;
  - Advertising in newspapers and business magazines, radio or any other media channel;
  - Participation with own stand in regional / national / international fairs;
  - Promotion of the technology portfolio in conferences and brokerage events;
  - Awareness campaigns for the activity field.

**Self-assessment**

At this point, the representatives of the audited company are required to complete on special assessment grids, with low-medium-high degrees, their opinion towards the company’s position compared to competition, regarding the:

- adaptation to technological advancement;
- internal technology audit tools;
- use of new technologies and equipment;
- development of new (technologically) advanced products;
- access to sources of technological advancements.
SWOT analysis

After returning to their headquarters, the auditors analyze the questionnaire which was completed with the company representatives and, on the basis of the information gathered, start performing the SWOT analysis. This is a strategic planning method used to evaluate the Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T) involved in a company, project or business venture. The SWOT analysis is not a permanent document, but only a snapshot of the company at the time of the analysis, for emphasizing the strong and weak points (internal origin) as well as the opportunities and threats (external origin) for the company. While the strong points and the opportunities are helpful in achieving the company’s objectives, the weak points and threats are harmful (Fig. 3).

| INTERNAL ORIGIN (attribute of the organization) | STRENGTHS | HELPFUL to achieving the objectives | WEAKNESSES | HARMFUL to achieving the objectives |
| EXTERNAL ORIGIN (attribute of the environment) | OPPORTUNITIES |  | THREATS |

Fig. 3. Elements of SWOT Analysis

The SWOT analysis should be completed in a bold manner, related to the competition and its 4 elements should be clearly defined, avoiding the so-called “grey-areas”. Through the SWOT analysis, the company could find out where it is today and where it could be in the future.

1. Action plan

The Action Plan represents the final report of the TA, comprising the following elements:
- overview of the company and its activities;
- overview of sectors and markets;
- identification of Strengths, Weaknesses, Opportunities and Threats;
- solutions for solving the encountered problems;
- suggestions for exploiting company’s strengths and opportunities.

Moreover, the Action Plan should have:
- a time frame;
- clear milestones for carrying out the proposed solutions;
- an estimated budget for carrying out the proposed solutions;
- a list of expected deliverables;
- identification of potential problem solvers.

In a few words, the Action Plan should be a concrete set of recommendations leading to the technological improvement of the company.
Expected results / benefits of a TA for the company

The expected results of a carefully conducted TA mainly concern:
- a complete and comprehensive analysis and evaluation of the requirements of the company for its sustainable growth;
- a fair and impartial SWOT analysis;
- thorough Action plan, containing a complete and comprehensive analysis and evaluation of the points where special attention or immediate action is required and how it should be performed;
- opportunity spotting for new products / new services / new technologies / new markets;
- networking with technology suppliers, technological sources, other companies;
- assessment of its technology portfolio and IPR, basis for future RTD projects;
- possible investigation and identification of potential funding mechanisms.

Time spent on a TA

As one could have already remarked, to perform a TA is resource demanding and the time spent on its different stages is approximated as it follows:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activities</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Pre-audit phase</td>
<td>Preparatory work</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>- Preparatory work</td>
<td></td>
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<tr>
<td></td>
<td>- Questionnaire making</td>
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<td></td>
<td>- Web research</td>
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<tr>
<td></td>
<td>- Other sources research</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company visit and pre-audit assessment</td>
<td>1 day</td>
</tr>
<tr>
<td>TA tool</td>
<td>Completing questionnaire concerning:</td>
<td>1-2 days</td>
</tr>
<tr>
<td></td>
<td>- Organigramme and human resources</td>
<td></td>
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<tr>
<td></td>
<td>- Products and markets</td>
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<td></td>
<td>- Production and packaging</td>
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<td></td>
<td>- Quality control</td>
<td></td>
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<td></td>
<td>- Research and technology level</td>
<td></td>
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<tr>
<td></td>
<td>- Marketing policy</td>
<td></td>
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<tr>
<td></td>
<td>- Self-assessment</td>
<td></td>
</tr>
<tr>
<td>SWOT analysis</td>
<td>Identification the strengths, weaknesses, opportunities and threats for the company</td>
<td>1-2 days</td>
</tr>
<tr>
<td>Action plan</td>
<td>- Overview of the company and its activities;</td>
<td>2-3 days</td>
</tr>
<tr>
<td></td>
<td>- Overview of sectors and markets;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Identification of Strengths, Weaknesses, Opportunities and Threats;</td>
<td></td>
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<td></td>
<td>- Solutions for solving the encountered problems;</td>
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<tr>
<td></td>
<td>- Suggestions for exploiting company’s Strengths and Opportunities</td>
<td></td>
</tr>
<tr>
<td>TOTAL TIME SPENT ON TA</td>
<td></td>
<td>7-10 days</td>
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</table>
Conclusions

The Technology Audit is a tool for evaluating technological status and capacity, procedures and processes applied and technological needs of a company. It requires much more detail and effort than a company visit and definitely an active engagement from the company.

The TA has four different stages, each of them with its specific importance. If any is not properly approached, the process of TA itself will be compromised.

The SWOT analysis resulting from the Technology Audit aims at creating an accurate picture of the present moment for the company, emphasizing the weaker parts, that need to be corrected, and the strong ones, that give the company the possibility to boost.

The Action Plan starts from SWOT and provides the SME, within a schedule, the necessary managerial and technical advise, in order to improve its technological level and evolve in such a way that would at least maintain its present market share if not rise it.

Extended to the level of a certain domain or region, TA is useful to establish a specific general problem. If the entitled authorities would eventually take into serious consideration these reports, at least few of the necessary solutions shall be provided, leading to economic regeneration.

REFERENCES

Barsan, S.C., Sima, M.G., 2008, Inovarea şi transferul tehnic-armament de aliniere a IMM-urilor la cerinţele economiei de piaţă, Seminar “Interferenţe economico-sociale la frontieră inovării” – editia 1;
Brown, David, 1997a, Getting the Best from Innovation Management Techniques, Centre for Small and Medium Enterprises, Warwick Business School, University of Warwick, United Kingdom
Brown, David, 1997b, Innovation Management Tools: A review of selected methodologies, European Commission,
Nicolescu, O., Verboncu, I. 1999, Management, Editura Economica, Bucureşti
Sima, M.G., 2009, Role of Technology Transfer Center in the promotion, protection and capitalization of industrial property: the impact on competitiveness of Romanian SMEs, rev. Hidraulica, nr.3, pag.21-25;