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EFFECTIVENESS OF TECHNOLOGY AUDIT AS SUPPORT TOOL FOR INNOVATIVE SMES

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External expert support reinforces SMEs capabilities in their efforts towards successful commercialization of their innovation. This research explores the influence of technology audit expert service on innovation performance of SMEs. Technology audit is a process which is designed to establish a baseline for technology and identify new products and systems that will contribute to company development. It aims to improve the adequacy and validity of the technology level of a company. During the research which was made in innovative SMEs significant positive relationship was found between technology audit used and the different indicators of the innovation performance which confirms the high impact of the technology audit methodology on the innovation performance of analyzed organizations.

Science and technology progressing with a fast pace, knowledge is becoming increasingly complex and widely distributed, so it becomes more and more difficult for one company to innovate by itself. The idea of open innovation suggests that valuable external knowledge should be systematically identified and acquired, assimilated, transformed and exploited.

Technology transfer is one of the open innovation activities promoting technical innovation through the transfer of ideas, knowledge, devices and artefacts from leading edge companies, R&D organisations and academic research to more general application in industry and commerce [1]. However, the process is rarely straightforward and needs to be aligned to strategy, management, financing and resource development. To make things even more complex, innovation in most of the SMEs takes place in *ad hoc* projects, and as the innovation project progresses, they adapt their organisational set-up accordingly. This makes a very challenging reality for small and medium-sized enterprises (SMEs) which should tackle the shortage of time, resources and expertise to find new ways to connect to other parties, source knowledge and generate value out of it.

Technology audit (often provided as external service) is designed to help firms to cope with this complexity. The general aim of the technology audit is to evaluate the capacity of firms and organizations to integrate new technologies, work with technological partners and better define what they need to successfully integrate these technologies into the company [2, 3].

More specifically, a technology audit must make it possible to characterize the needs of an SME related to the innovation management from different points of view - positioning of products/markets, technological areas that need attention, functions/problems of general nature requiring innovative solutions; means for transferring technology, such as training partnerships for technological development, technical aid, intellectual property rights, financ¬ ing, etc; sources and channels of innovation that can be tapped and relations that can be developed. A standard technology audit does not exist. This proc¬ ess heavily depends on different organizational aspects such as type of or¬ ganization, field and level of technology used, usage of information technolo¬ gies, etc. However most technology audits have the same general structure and follow a pattern in terms of timescales:

- **Initial phase.** It includes discussion with the CEO/owner to agree the scope and purpose of the audit, the framework for the report to suit the enter¬ prise, to select those to be interviewed. Initial information about the enterprise (published and unpublished reports) is gathered at this stage.
- **Interview phase.** This phase needs a balance of structure and flexibility to cover all potentially important areas in the appropriate depth. It starts with a review of initial information to draw out more detail in important areas. Addi¬ tional questions may be asked to establish attitudes to exploitation of opportuni¬ ties. For certain categories of opportunity, is important to identify whether the key person is an entrepreneur, inventor, manager, researcher or all of these.
- **Report phase.** As the draft report is prepared, using the agreed frame¬ work, the external expert should use his market knowledge to identify mecha¬ nisms or routes to exploitation of opportunities. Time considerations are likely to prevent this being extensive market research or marketing and these activities fit better into the action plan developed to act on the findings of the audit. The audit is thus concerned with "uncovering the raw material for exploitation". The draft report should be reviewed by the internal auditor and the CEO, and pref¬ erably by the individuals interviewed as well, to give an opportunity for feed¬ back prior to the report being finalised.

In this study, we focus on the impact of the technology audit process to the innovation performance of the SME. Several innovation performance ap¬ proaches/indicators were selected and categorized into three groups with respect to their properties [4]:

- Rate of product innovation (number of product changed to total prod¬ uct; change in sales (due to product change) to total sales; change in profit (due to product change) to total profit).
- Rate of process innovation (number of process changes to total proc¬ esses; change in overall productivity due to product change).
- Technology indicators, (percentage of expenditure on R&D to total sales; number of technologies adopted externally; number of patents developed internally).

Empirical data were obtained through a random survey in of 356 manag¬ ers, most of whom were senior managers who had knowledge of past and pre-

sent organizational practices relating to quality and innovation related aspects in the organization. The sample was selected randomly from the Lithuanian Innovation Centre's database that encompasses various industry sectors, including both manufacturing and non-manufacturing sectors. All the companies in this data base have an innovative aspect. The proportion of the respondents was nearly equal between manufacturing and non-manufacturing sectors (48,3% and 51,7%, respectively). The non-manufacturing sectors include such areas as construction, consulting, health care, and ICT. In terms of organizational size based on the number of employees, 92% of the respondents came from firms with 250 employees or less and from this around 69% of them were from firms with less than 100 employees. Half of the respondents were those responsible for operations in the firm, including production managers and quality managers, one-third of them were senior managers (General Manager or Managing Director), and the rest were managers from other functional areas, such as marketing, finance, human resources, and administration.

The results of the SME analysis indicates that just a 10 percent of the innovative SME uses the methodology of the technology audit, other methods are used more often, for example the automated matching tool (AMT) is used in 93% of analyzed cases. Nevertheless companies which implemented a technology audit methodology acknowledge the need for it.

Table

Mean, standard deviation and Spearman correlations of technology audit and innovation performance of the SME

Variable	Means	SD	Rate of product innovation	Rate of process innovation	Technology indicators	Overall benefit
Technology audit used	4,22	1,17	0,47	0,444	0,473	0,419

Furthermore, the relationship between used technology audit methodology and innovation performance of the SME indicators was examined in order to substantiate the impact of the technology audit process to the innovation performance. For this reason Spearman's rank correlation coefficient was calculated. It does not require the assumption that the relationship between the variables is linear, nor does it require the variables to be measured on interval scales; it can be used for variables measured at the ordinal level. In Table, Spearman correlations range from 0,444 to 0,473 with $p \leq 0{,}001$. Significant positive relationships are found between technology audit used and the different indicators of the innovation performance of the SME which confirms the impact of the technology audit methodology on the innovation performance of analyzed organizations.

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ИННОВАЦИОННЫЕ МЕТОДЫ ПРОИЗВОДСТВА МАКЕТОВ ИЗДЕЛИЙ СРЕДСТВАМИ БЫСТРОГО ПРОТОТИПИРОВАНИЯ

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Рассматривается технология быстрого прототипирования методом струйной трехмерной печати. Описана общая схема оборудования, построенного на основе данной технологии и этапы производства изделий. Приведены примеры разработки макетов промышленных изделий в области машиностроения.

В последнее время популярными стали технологии быстрого прототипирования (RP - rapid prototyping), то есть послойного синтеза макета по компьютерной модели изделия [1, 4].

Современные прототипы позволяют не только оценить внешний вид изделия, но и проверить элементы конструкции, провести необходимые испытания и т. д. [3].

Использование RP-технологий в прототипировании способно существенно сократить сроки подготовки производства, практически полностью исключить длительный и трудоемкий этап изготовления опытных образцов вручную, или на станках с ЧПУ [2, 5].

Струйная трехмерная печать (3DP) - один из методов быстрого прототипирования. Струйная трехмерная печать подразумевает послойное построение моделей физических объектов на основе трехмерной геометрической модели. В качестве расходных материалов могут использоваться различные порошки, последовательно наносимые тонкими слоями.

Общая схема 3D-принтера, основанного на рассматриваемой технологии, представлена на рис. 1. Оборудование разделено на две основных камеры: для хранения порошка и для построения модели.

В начале процесса первое отделение заполнено материалом, а второе - пустое. При печати тонкий слой порошка при помощи выравнивающего ролика перемещается из первой камеры во вторую. Далее печатающая го-