

TECHNOLOGY-DRIVEN INNOVATION: APPLYING THE TECHNOLOGY TO PRODUCT TOOL IN AN EDUCATIONAL SETTING

Ann DE KEERSMAECKER, Alexis JACOBY and Chris BAELUS
Artesis University College, Antwerp

ABSTRACT

Technology to Product is a software tool to support technology driven innovation at the Front End of Innovation. The tool is result of a close collaboration with researchers (Artesis University College), an innovation consultancy and a product development firm.

The Technology to Product software tool provides five supporting modules. The *Front End Guide* gives an overview of the three different activities during the early stage of the design process. It describes a step by step approach taking functional, technological and market related aspects into account and guides the designer through the process. The *Tech Check* questions the status of the three stages and gives indications on the required level of awareness, knowledge and the readiness for productizing. *The Generator* stimulates the ideation by defining the technical functions of the technology at a generic abstraction level and linking them with relevant product functions, resulting into new applications and feasible competitive markets. The *Matchmaker* evaluates the fit of the selected applications with the technology and vice versa. The evaluation is based on product performance levels and seeks for a balance between the added value provided by this characteristic and the efforts needed to adapt the technology. The *Moneytimer* estimates the economic feasibility of the application by visualizing the relation between payback time, launch and development costs and return on investment.

Because of its parallel make-up with the methodology of the curriculum, the implementation of the toolbox in design education seems promising. The toolbox is illustrated with some technology driven master projects.

Keywords: Technology to product, technology driven innovation, supporting toolbox, front end of innovation, idea generation

1 INTRODUCTION

Technology is a key aspect of the innovation cycle. New products can be regarded as the new combination between new product functions, new product markets and new product technologies [1]. New product functions describe what a product actually can do. The new products technology describes how the product is manufactured or in which way the product can fulfil its function. The new product market describes the target market or the target customer the product is meant for [2].

Technology development and product development are to be regarded as two separate processes. Technology development is the process that leads to state-of-the-art technologies, ready to be implemented. Product development starts from these state-of-the-art technologies to integrate them with user functions and target markets. Product development integrates technology. The transition from technology development to product development is often referred to as technology transfer [3].

Technology is a key driver for innovation and many radical innovations are based on new technologies. As a result, product development processes interact in many cases with technology development processes [2]. Either technology is a starting point for product development or technology searches are performed during the product development process in order to find the right solution for a specific problem. A third interaction occurs when exploration of new use cases leads to the development of new technologies.

According to the concept of technology push, a new products development process based on new technologies encounters specific problems and asks for a specific approach [1]. This paper discusses the development of the supporting T2P tool and the implications for the educational context of technology driven idea generation.

2 DESIGN OF THE TOOLBOX

The aim of the design of the Toolbox ‘Technology to Product’ is to support the technology driven innovation activities. Therefore, the focus is on the Front End of Innovation, the first stage of the innovation process. The Technology-to-Product (T2P) tool was originally developed for implementation in small and medium sized enterprises (SMEs) in the Flemish region, Belgium and was developed at the product development faculty in Antwerp together with an innovation consultancy and product development firm.

A preliminary study based on a survey and interviews with managers from SMEs made clear that SMEs are most of the time not familiar with a technology driven innovation strategy, although they might have potential technologies in house. Furthermore, in this preliminary study, it appears that SMEs are not aware of the early innovation stages, and the associated tools to support them.

Existing knowledge of technology driven innovation, roadmaps, methods and tools were collected, explored, evaluated and ranked during sessions that were organized with medium-sized companies and multinationals. Based on the feedback several problems and gaps in the existing approach were identified to optimize the early stages of the development process. SME’s indicate that there is a lack of knowledge of the specific methodology for technology driven innovation and the effective implementation of supporting tools.

The research project looked deeper in technology driven product development and detected five gaps in the approach to proficient technology driven innovation: a need for better orientation of the starting point for a technology driven approach, a need for criteria that can be used for assessment and decision, a need for better characterization of technology, a need for better tools to work on adaptations of existing technologies to the new context and the need to define early business cases. For each of those needs, a small software-based tool was developed. The software visualizes these 5 approaches and stimulates the dialog between different disciplines and facilitates communication on those 5 issues. In that way, it will create support for consultants, project leaders and mentors helping SMEs with technology driven innovation, and stimulates a dialogue on the approach in the company.

Because the design of the tool is based on innovation methods known at the Antwerp University College, we also use the toolbox in an educational setting. The goal of the T2P project was to translate expert knowledge into easy accessible useful tools, making them available for SME’s. Because of a similar level of expertise in this field the tools are also relevant for the Masters students.

3 DESCRIPTION OF THE 5 TOOLS

The tools support the searching and selecting of new applications for the technology. The general scheme (Figure 1) gives an overview of the five tools and illustrates the focus of each tool. The tools are classified according to their position in the Front End of Innovation, and what domain they cover. The overall idea is that a designer can start with a given technology, still in development, or already in use in an application. The different tools address a specific need in the technology driven approach to idea generation in the Front End of Innovation.

The T2P tools are not only a useful instrument in the SME context but can provide additional support in student’s work in the early product definition stages of the master proof in product development. In some cases, use of the tool by students is illustrated.

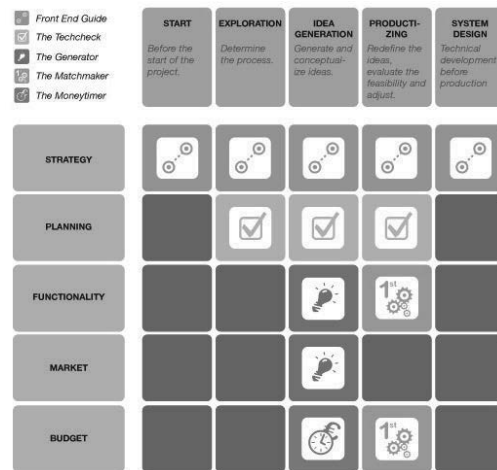


Figure 1. Technology to product tools scheme

3.1 Front End Guide

The tool addresses the problem that companies face when they start a technology driven project in the Front End of Innovation. A major difficulty is to detect the required starting point. What knowledge is available? Which is the first step to take, considering actions that have been undertaken in the past? This tool gives a preliminary overview of essential steps in the front end of innovation: exploration, idea generation and productizing. In every step, it is important to address three domains: technology, function of the product and market. The Front End Guide questions the situation and proposes a starting point and advises a start approach concerning use of tools from the T2P toolbox, and other existing tools (Figure 2). Therefore, it is very oriented towards the specific setting of the firm.

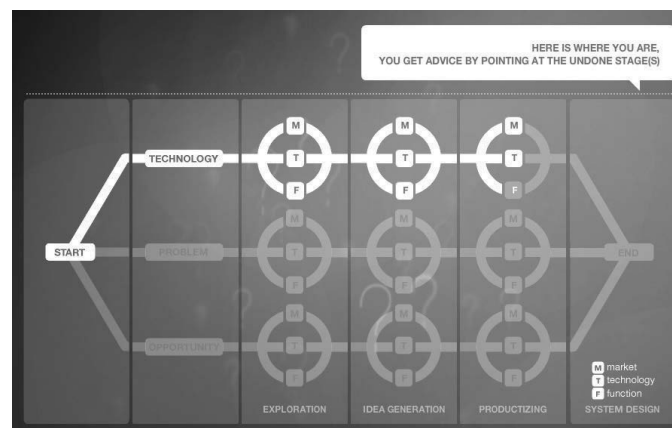


Figure 2. Screen shot Front End Guide

3.2 The Tech Check

The Tech Check tool focuses on readiness assessment on different abstraction levels of the product development process and on the different perspectives of market, technology and the product itself. The first stage is exploration where the designer needs to be aware of critical factors on the three perspectives. Second stage handles the idea generation where all market, technology and product functionality are known and stated feasible. In the third stage all three aspects will be developed in detail, and a feasible product concept can be proposed. Through different questionnaires one can detect and communicate the readiness to enter a next development stage.

By this questionnaires, the user of the tool oversees the 'to do's' in each stage and can get aware of missing activities that needs to be fulfilled. The Tech Check tool gives the possibility to indicate the status (started/busy/done) and gives a visual output (Figure 3) to communicate progress of the technology driven project and creates an agenda for future action.

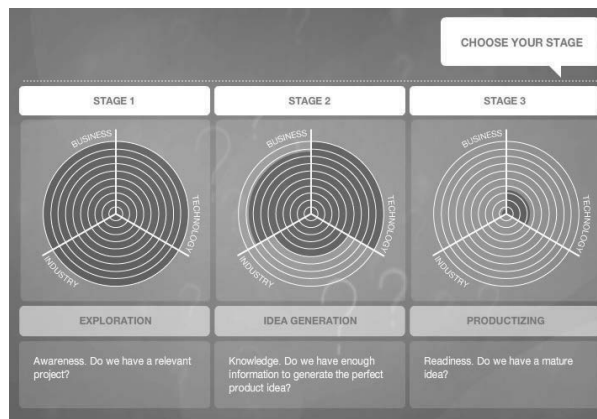


Figure 3. Screen shot The Tech Check

3.3 The Generator

This tool facilitates one of the most important actions of technology driven idea generation: the characterization of the technology in a creative way to provide the base for idea generation.

Abstraction of the technology is essential to understand the technology and to find later on applications that lie in the possibilities of the functions of the technology. In order to make this process easier, it is important to understand the basic functions of the technology. Characterization of the technology needs to be done by describing the actual functionality rather than the engineering characterization as the last one is only of minor importance in the idea generation stage. The Generator tool uses a complete list of abstract technology functions [4] to support the understanding of the functions of the selected technology. The tool suggests linking subjects to the functions and searching for synonyms to push the designer into diversifying the functions of the technology (Figure 4). Furthermore, the technology functions will be translated into design directives. The next important part of the tool is to link the design directives with the market and generate applications for the technology.

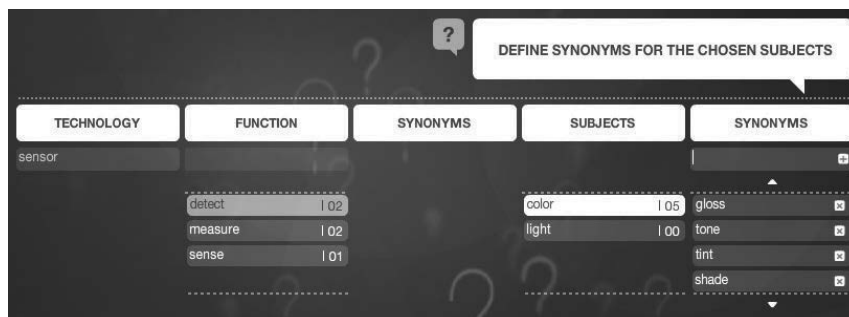


Figure 4. Screen shot The Generator

The Generator tool was used in a Master proof starting from a material as a ‘technology’. The purpose was to detect and assess application for a fast curing PU damping elastomer.

The material was abstracted by a range of functions. Each function was in detail analyzed and compared with other materials in order to find the distinctive functions, specific for this material (Figure 5). By detecting distinctive functions, it becomes possible to search for application that fit this material.

Subsequently, the distinctive functions were brought to an abstraction level by using the Generator. As a result, a tremendous amount of ideas for applications were generated (Figure 6).

3.5 The Moneytimer

The Moneytimer tool addresses the economic aspect in the Front End of Innovation. Even in this early stage, it is important to start thinking about the possible Return On Investment (ROI) and payback period of development and launch costs in order to eliminate ideas that are not economic feasible. Determinants like sales numbers, targeted ROI, development costs, production and non-production costs needs to be estimated. Estimation, for example, of the development costs is essential to understand the dimensions of the new project. Also, estimation of possible success in the market is important and can be done by roughly think about sales numbers and price setting.

This tool is a method to visualize the important parameters (ROI and payback time) so comparing between two product scenarios becomes possible (Figure 10) and a discussion regarding the critical economic aspects can be facilitated.



Figure 10. Screen shot The Moneytimer

4 CONCLUSIONS

Technology driven innovation is a process that is often executed by companies and students product development at the Artesis University College. Nevertheless, information on a structural approach and methods to support this process are not widely known. The Technology to Product Toolbox creates an answer. The presented toolbox is specifically designed for implementation in the Front End of Innovation. It is created with a user group of SMEs to verify relevance for industry and represents certain methods used to create ideas, based on the technology driven method used at the Artesis University College. The tool can be used in a SME setting, as well as in an educational setting.

In this paper the tool is explained with examples of students' graduate projects using parts of the toolbox.

REFERENCES

- [1] Braet, J. and Verhaert, P. *The practice of new products and new business*, 2007 (Acco, Leuven).
- [2] Jacoby, A., De Keersmaecker, A. and Braet, J. Technology development and product development in the front-end of innovation: a review In *4th European Conference on Entrepreneurship and Innovation (ECEI)*, Antwerp, (2009).
- [3] Harmon, B., Ardishvili, A., Cardozo, R., Elder, T., Leuthold, J., Parshall, J., Raghian, M. and Smith, D. Mapping the university technology transfer process. *Journal of Business Venturing*, 1997, 12, 423.
- [4] Hirtz, J., Stone, R. B., McAdams, D. A., Szykman, S. and Wood, K. L. A Functional Basis for Engineering Design: Reconciling and Evolving Previous Efforts In National Institute of Standards and Technology: (2002).