



Universidade do Minho

Escola de Engenharia

## **Semana da Escola de Engenharia October 24 - 27, 2011**

# **SHEET METAL PROCESSING EQUIPMENT AND MARKETS UNDER UNCERTAIN FUTURE ENVIRONMENTS: A FRAMEWORK TO ASSIST TECHNOLOGY STRATEGY DECISIONS**

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### **KEYWORDS**

technology strategy, resource based view, uncertainty, decision models, economic evaluation.

### **INTRODUCTION**

The current economic climate, characterized by the effects of globalization such as fierce competition and faster-paced introduction of new technologies, is forcing companies to constantly readapt their strategies in what concerns product development and technology investments. Being confronted with such forces, firms are facing difficulties in making the right decisions concerning new technological developments, for the objective of maximizing the value of their businesses. Any complex decision is always associated with a certain level of uncertainty. In the case of technology strategy decisions, R&D investment might exceed the initial budget, supplies costs may increase, demand can be higher than expected, etc. A significant number of scenarios can be drawn from this analysis, and, as time passes by and more information is collected, a clearer picture of the value of technology takes place. A suitable approach to deal with uncertainty, capable to minimize losses and maximize gains, is required by most firms. The aim of the present research is to define a proper framework of analyses that support the process of technology strategy formulation in firms. The developed framework will be tested and validated in a medium sized company in the business of sheet metal processing equipment (press brakes, shears and laser cutting machines).

### **BRIEF LITERATURE REVIEW**

This research covers broad areas of knowledge: strategic management of technology and decision support tools for technology evaluation.

A number of authors have investigated the process of technology strategy formulation and highlighted their inherent decisions. In (Chiesa, 2001), three decisions are described: technology selection, timing of technology development and introduction and technology acquisition mode. (Burgelman et al., 2004) goes further and includes the decisions about which technological competencies and capabilities to develop, the investment level in technological developments, the manner for sourcing the technologies (internally or externally) and the way technology and innovation should be organized and managed in the company. But how can we evaluate the technological positioning (strengths and weaknesses) of a firm? How will the expected technological evolution affect the performance of these systems? Which trends can we foresee in technologies and markets? Which technologies shall provide the firm with sustained competitive advantage? In order to answer to these questions, firms should take a rational approach for the formulation of their technology strategies.

Concerning the process of technology strategy formulation, there are two approaches that can be followed, as mentioned by (Chiesa, 2001): the *positioning school*, which states that firms can achieve success by adopting competitive strategies based in industry and market structures (the “outside-in” perspective), and the *resource based school*, a field of strategic management which explains how firms achieve sustained competitive advantage by adequate management and exploration of their resources (the “inside-out” perspective).

For the purpose of this research, the resource based approach to strategy will be followed, as it remains a rather unexplored scientific area, as opposed to the positioning school of strategy.



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### RESEARCH METHODOLOGY

As mentioned before, this research follows a case study approach. The study will be conducted along several stages, which are depicted in Figure 1.

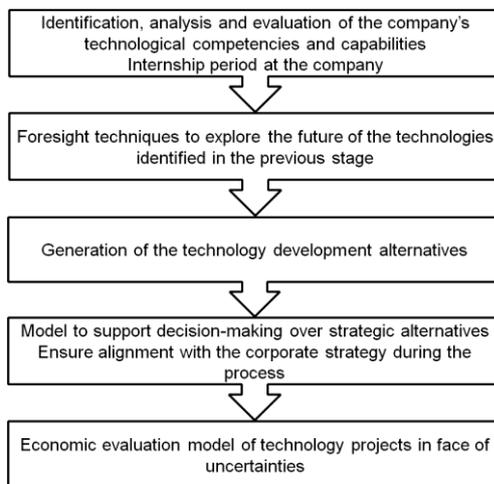


Figure 1 – Stages in Research Methodology

- 1) **Identification, analysis and evaluation of the company's technological competencies and capabilities (internal context):** a method for evaluating technological competencies and capabilities shall be implemented in this stage, in order to understand the strengths and weaknesses of the company. This will be developed during the internship period at the company used as case study;
- 2) **Foresight techniques to explore the future of the technologies identified in the previous stage (external context):** predictions over the future of the technologies belonging to the resource base of the company shall be studied at this stage; using techniques such as Delphi method or semi-structured interviews with specialists in this area;
- 3) **Generation of technology development alternatives:** having analyzed the internal (1) and external (2) contexts, new technology development programs shall be generated, with the participation of the firm's management and technical personnel;
- 4) **Model to support decision-making over strategic alternatives:** a decision-model is developed to help the company management to decide over the generated strategic choices. The output should be a technology strategy program, which is aligned with the corporate strategy;

- 5) **Economic evaluation model of technology projects in face of uncertainties:** the last stage concerns the economic analysis in the face of uncertainties over the course of the technology development. Techniques such as Real Options shall be used for this purpose.

### PRELIMINARY RESULTS

At the present state of the research and after an internship period at the company, a first draft of the method for evaluating technological competencies and capabilities has been developed, which shall be validated by specialists in the area of technology management and then implemented in the context of the company.

### EXPECTED CONTRIBUTIONS

The end result of this research should be a framework of analyses that yields an appropriate technology strategic plan for the company. The framework should support decision making in various fronts: the identification and evaluation of current technological competencies, forecasting the technology landscape, selection of the most appropriate technologies for future implementation, technology acquisition sources.

The research expects to provide significant contributions to the process of technology strategy in firms. By making use of the case study approach, we expect to provide useful and more detailed insights when compared to large surveys across many firms on this theme.

### ACKNOWLEDGEMENTS

This research is supported by Fundação para Ciência e Tecnologia (scholarship reference SFRH / BD / 33727 / 2009), within the framework of the MIT Portugal Program.

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**CLÁUDIO SANTOS** was born in Rio de Janeiro, Brazil, having moved to Portugal in 2002, where he finished his degree in Industrial Engineering at the University of Minho. He worked for a couple of years abroad (as an intern in the Portuguese Business Development Agency in Mexico City

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