

Local Rationality, Resource Accumulation Structures and Emergent Strategic Behaviour in Explaining R&D Resource Building and Adaptation

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1. Introduction

The literature of R&D portfolio management illustrates how R&D resource portfolio management in a large multi-business firm is a complex system which aggregates many interconnected sub-process and actors.

Morone [1989], for example, pointed out how business units and corporate top managers compete in influencing the direction of research activity conducted in R&D departments. Moreover, R&D resource and capability management in multi-business firms has also to consider the feedback that links decisions to their consequences. For example, Scholefield [1994] highlighted that the performances of a business set a ceiling for the R&D resources allocated to it, and the R&D resources allocated set a ceiling to the feasible business strategies that are likely to result.

This has created concerns about how project selection mechanisms and the management of the R&D resource portfolio are coupled with corporate strategy-making in order to co-ordinate resource building, business needs and corporate goals. Indeed, a recurring puzzle [Ruggles, 1982; Venkatraman and Venkatraman, 1995; Coombs, 1996] concerns firms' inability to couple corporate goals with existing R&D resources and activities. This mismatch generates such undesired consequences as high rates of project refusal, fluctuation and underutilisation of valuable human resources, and frustration of the underutilised capabilities [Venkatraman and Venkatraman, 1995].

The present work aims at explaining the origin of the discrepancy between desired and effective corporate R&D capability portfolios, and the fluctuation in R&D capability utilisation. A System Dynamics simulation study, grounded on a business

case, represents R&D capability portfolio management as a complex resource accumulation system; and highlights the role of resource accumulation structures in directing R&D portfolio evolution.

2. Research Context

The case studied is an integrated company operating in the oil and natural gas, petrochemicals, and oilfield services contracting and engineering industries.

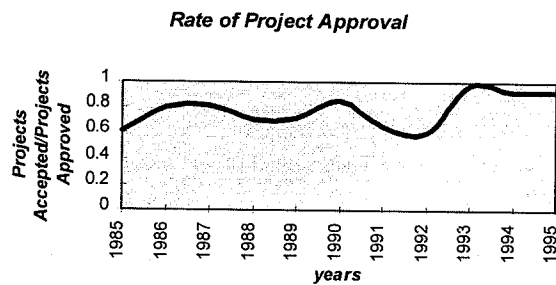
The centralised R&D activity covers four areas of research. Oil Upstream, Oil Downstream, Environmental Protection and Restoration, and Alternative Sources of Energy.

These four areas of research impinge upon four core R&D capabilities: colloids and chemical synthesis, thermal processes, catalytic processes and environmental sciences.

3. Historical Behaviour

The System Dynamics model explores resource allocation behaviour in the different research areas of the organisation. In particular, it addresses the forces that influenced the evolution of the portfolio of R&D capabilities. Major concern is the explanation of the origins of this mismatch between R&D activities and capability portfolio and corporate strategic objectives. Such a mismatch has generated persisting discrepancy between the submitted projects and the accepted ones; and has produced oscillations in capability utilisation. Figure 1 shows the historical behaviour of the rate of project approval (project approved/projects submitted).

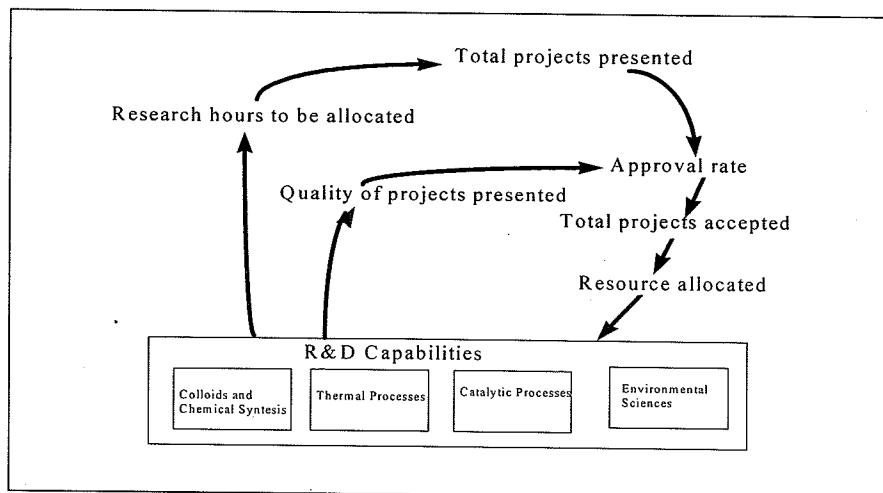
Figure 1 - Reference Modes: trend of the rate of project approval



3. Dynamic Hypothesis

Figure 2 presents a major dynamic in the case studied. R&D capabilities in the different research areas determine the number and the quality of projects submitted for approval. The quality and the number of projects submitted affects the number of projects that will be ultimately approved. The higher the number of project accepted in each research area, the larger the amount of resource allocated to that research area and the higher the possibility to enhance capability building and further augment future chance of project approval.

Figure 2 - Dynamics of R&D capability accumulation



4. Preliminary Findings and Further Research

One crucial decision firms deal with concerns enhancement, development or refocusing and dissipation of organisational R&D capabilities. In this light, particularly crucial is the coupling between evolution of a portfolio of R&D capabilities and firm strategy-making. Using System Dynamics modelling, this paper represents R&D capability management as a complex process embracing corporate, business and technology strategic decision-making. The study proposes three considerations. First, System Dynamics is particularly useful to elicit, represent and study the structure of strategic decision-making embedded in the corporate context. Second, the evolution of R&D capability portfolio can be explored through the analysis of feedback structure which underpins strategic decision-making in

organisations. Discrepancy between desired and actual R&D capability portfolio can be explained by the misperception that boundedly rational decision-makers have of the feedback structure in which they are embedded. Three, this study has revealed promising avenues for further research. In particular, the built System Dynamics model will be used to explore the co-evolution of R&D capability portfolio and business and technology strategy, thereby illuminating an intriguing theoretical territory in the strategy literature [Burgelman and Rosebloom, 1989].

References

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