

Success Factors and Challenges during External Technology Exploitation of R&D Companies in Cameroon Shanghai University China

Muffuh Bertrand Akehmbom

Abstract: *Several divisions in the process industry are facing numerous challenges due to changes in the process industry landscape. Factors related to the recession, climate change and an increasing competition have left its mark. Consequently, there are several units within the process company that seeks other opportunities in order to extend their expertise and develop innovative technologies in new landscapes within the process Industry. As it has been increasingly prevalent for companies to participate in a partnership with external actors in order to develop and commercialize new innovative products and solutions, it is still a rather complex process and has insufficiently been reflected upon in academic studies.*

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I. Introduction

While external knowledge acquisition is well studied and understood, the external exploitation side of open innovation remains challenging. First we present the contemporary process models for external exploitation, describing the different steps along with relevant challenges and actions. Then, we identify major overall challenges in external knowledge exploitation and investigate limitations to applying open innovation approaches. Finally we find recurring themes in literature implying that pre-commercialisation phase activities may provide the critical support for successful management of external exploitation of non-core technologies. We conclude with implications for innovation and learning as well as the identification of promising further research avenues. Several divisions in the process industry are facing numerous challenges due to changes in the process industry landscape. Factors related to the recession, climate change and an increasing competition have left its mark. Consequently, there are several units within the process industry that seeks other opportunities in order to extend their expertise and develop innovative technologies in new landscapes within the process industry. As it has been increasingly prevalent for companies to participate in a partnership with external actors in order to develop and commercialize new innovative products and solutions. Cameroon is a country in Central Africa. Cameroon's per-capita GDP Purchasing power parity was estimated as US\$2,300 in 2008, one of the ten highest in sub-Saharan Africa. Major export markets include France, Italy, South Korea, Spain, and the United Kingdom. Cameroon is aiming to become an emerging country by 2035. Cameroon has had a decade of strong economic performance, with GDP growing at an average of 4% per year. During the 2004–2008 period, public debt was reduced from over 60% of GDP to 10% and official reserves quadrupled to over USD 3 billion. Cameroon is part of the Bank of Central African States of which it is the dominant economy, the Customs and Economic Union of Central Africa UDEAC and the Organization for the Harmonization of Business Law in Africa (OHADA). The main objective of the thesis is to analyze the Case Company and to construct strategic suggestions to stay competitive. The aim of this master's thesis is therefore to investigate and analyze what challenges and problems R&D companies within the process industry faces when entering an alliance/partnership for external technology exploitation, and also identify success factors. The master's thesis is delimited to the planning phase of a project as it was identified as the most crucial phase. The purpose is to allow companies adjust their strategy more efficiently and competently when knowing what the potential problems and challenges are, thus providing results that would be of great practical use for R&D companies overall. The thesis was conducted by a quantitative approach, interviewing two dozen key persons and in-depth investigation of a project. Triangulation methods was employed in order to verify and strengthen the gathered data from the interviews, and analyzed in relation with literature. We have identified some challenges an R&D company could experience, such as risks related to coordination requirements, partner selection, planning tools etc. However, there are also some success factors an R&D company should contemplate upon, such as potential synergies between small inventions in order to utilize and attain a larger combined effect, and designing a strategic partner selection process.

II. Significance of Study

This thesis will benefit R&D companies/departments/institutes in the process industry that aims to join a partnership and collaborate with other external actors (R&D and/or non-R&D) in order to develop a certain technology, thus the definition 'external technology exploitation. External technology exploitation for R&D companies doesn't necessarily mean that R&D Companies actively pursuit commercialization opportunities for their technology with external actors. External technology exploitation could very well have the purpose of attaining new opportunities for new externally initiated projects by being part of innovation clusters and collaborating with partners that aims to commercialize new technology, implying that an R&D company doesn't have to commercialize the product themselves but rather being a part of the development process and let external actors handle the commercialization. This thesis will therefore benefit R&D companies engaged in such process by shedding light on the success factors, problems and challenges in order for them to address. The research is empirical It is important to be able to position an organization based on its manoeuvres and capabilities in the current competitive business environment. The development and exploitation of new innovative products and technologies in R&D companies require external funding and/or collaborative support by value chains with several actors, which deem the innovation process with several actors of innovation to be arge and complex. As the five main phases for external technology exploitation according to Lichtenthaler and Ernst (2007) [1] is planning, intelligence, negotiation, realization and control, only three are actually in a pre-commercialization stage. This thesis will investigate only the planning phase, one of the core critical factors in a pre-commercialization phase. External technology commercialization (ETC), i.e., the commercialization of technological knowledge exclusively or in addition to its application inside the firm, has recently become a broader trend. However, this increase in outward technology transfer, e.g., by means of technology licensing, has been insufficiently reflected by academic research. Thus, we lack a detailed understanding of the evolution and the current scope of ETC, which represents an important component of technology portfolio management. Moreover, our insights into the functions of ETC and into companies strategies, processes, and structures for managing ETC are limited. To address these research deficits, we present the results of a questionnaire-based benchmarking study in 154 medium-sized and large European firms spanning multiple industries. Thus, this article is among the first studies that provide quantitative empirical evidence for the current scope and management of ETC. After an introduction and theoretical considerations, the research design is described. Subsequently, the results of the survey are presented. In the final section, theoretical and managerial implications are discussed, and opportunities for further research are pointed out. Technology is often considered the practical application of science. Technology is not merely the application of knowledge generated by scientific activity; it is a body of knowledge about certain classes of events and activities. It is a knowledge of techniques, methods, and designs. Each technological paradigm defines its own concept of progress based on its specific technological and economic trade offs.

III. Literature Review

The aim of this master's thesis project is to investigate and analyze what challenges and problems R&D companies' faces in a planning phase when entering an alliance/ partnership for external technology exploitation, thereby also identify certain success factors. The purpose is by acknowledging the challenges and problems R&D companies possibly could experience, R&D companies would be allowed to adjust their strategies based on those potential challenges and problems that could occur in a planning phase. Furthermore, the most critical aspects in a planning phase could be managed more efficiently prior of instituting a partnership when knowing what the potential problems that could arise are. The provided success factors will also contribute for a more efficiently managed planning process. The thesis will have an academic context throughout the whole report, and as stated earlier the process of external technology exploitation is rather complex and has insufficiently been reflected upon in academic studies simultaneously provide results that would be of great practical use for R&D companies in Cameroon. A literature study has been ongoing throughout the whole process by investigating different types of collaboration, planning theories, and general articles about R&D, innovation. Lichtenthaler and Ernst (2007) [1] shows modes of R&D collaborations with diverse external entities, developing informal communication channels for knowledge exchange, joint ventures and strategic alliances. To realize innovation, different modes of engaging in are available to firms to source, acquire, transform and commercialize knowledge and resources. These modes include R&D collaborations with diverse external entities, developing informal communication channels for knowledge exchange, joint ventures and strategic alliances (Lichtenthaler and Ernst, 2007 [1]). In line with the resource-based view that emphasizes importance of resources at the companies disposal to achieve competitive advantage, firms select these modes of engagement based on their organizational characteristics, such as size, age, market orientation, industry type among others. According to Mortara (2009) [2], in open innovation processes, the organizational boundaries become non-existent, and R&D companies interaction with external

It means (universities, research laboratories, customers, expositors, venture capital companies) is raised. This opening of the innovation process therefore requires the creation of organizational mechanisms to encourage external collaboration. This platform supports a culture of innovations by promoting and recognizing them as the best ideas from those that result in new products to suggestions for the development of more efficient processes. In recent years, companies have increased their use of internal and external sources in pursuit of a competitive advantage through the effective and timely commercialization of new technology (Zahra and Nielsen, 2002 [3]). Grounded in the resource-based view of the firm, this study examines the effect of R&D company use of internal and external sources on multiple dimensions of successful technology commercialization. Mankind is living in the technology era and is seeing the influence of technology in every aspect of life, and in communities and societies (Hung 2011 [4]). The technology commercialization (TC) marketplace for R&D companies plays a crucial role in increasing technology-related developments and demand. As part of a new focus on sustainability, this study examined the effects of technological attributes, market potential and environmental factors on the technology commercialization of R&D companies. (Kutvonen, A.2011[5]). A literature review of works combining strategy, and lead to conceptualizing an array of strategic benefits including novel concepts. The review focuses on the empirical observations reported by previous research. This paper presents the most comprehensive description of strategic objectives that may be pursued, with several case examples. Objectives are classified to six categories: gaining access to new knowledge, multiplication of own technologies, learning from knowledge transfer, controlling technological trajectories, external exploitation as a core business model and exerting control over the market environment. For the manager, acknowledging the external opportunities for a firm's knowledge assets allows shifting from "just profit" externalization to a more strategic control over the company's future and its environment. Originality/value- Whereas the common viewpoint in connecting between strategy is to minimize the negative impact, while retaining monetary benefits, this paper views as an enabler of further strategic mobility and flexibility. Besides the challenges of actually transferring knowledge, the imperfections inherent in knowledge markets lead to appropriability issues and to high transaction costs (Brockhoff, 1992 [6]; Caves ., 1983 [7]; Ford & Ryan, 1981 [8]; Guilhon, 2001 [9]; Teece, 1981 [10]). Owing to the market imperfections, the *identification of potential knowledge* customers constitutes a major challenge. This task is often considered the essential problem in the proactive external commercialization of knowledge (Elton et al., 2002 [10]; Sullivan & Fox, 1996 [11]). A company that tries to commercialize a particular knowledge asset owns a potential solution for certain problems by providing one or more functions that the knowledge may fulfill. Starting from these functions, the firm faces the difficulty of identifying possible applications, which may be in completely different contexts from the firm's own business. In addition to the difficulties in identifying potential partners, considerable problems arise in the actual commercialization of knowledge. This problem can only partly be compensated through the codification of certain knowledge components (Teece, 1981 [12]). Secondly, the mere act of marketing knowledge comprises the risk of disclosing its relevant aspects to potential buyers (Arrow, 1971 [13]). According to Arora & Fosfuri, 2000[14] competition in the market for technology induces licensing of innovations and incumbent firms may find it privately profitable to license although their joint profits may well be higher in the absence of any licensing. A strong testable implication of our model is that the number of licenses per patent holder decreases with the degree of product differentiation. As several process technologies have been developed and the knowledge that competitors can license a process from different sources has forced the large R&D firms to license their own technology to their competitors. This has created a special structure in the market for technology in the R&D industry where many firms use and depend on their competitors' technologies and related RDI, which leads to a rapid diffusion of key technologies across the globe. (Teece, 1988 [15]). Teece himself has recently noted that, under certain conditions, trade in technologies is possible and likely. For example Teece, 1998; and Grindley and Teece, 1997[16]). In short, markets for technology are emerging and developing in several high-tech companies. However, companies that commercialize knowledge still face considerable difficulties because of appropriability problems. Apart from the characteristics of knowledge as the good itself, various problems in knowledge transactions arise from issues regarding an adequate *compensation for the knowledge transfer* (Bidault, 1989 [17]). It is difficult to establish an adequate price by comparing the current situation with prior knowledge transactions. Thus, knowledge transactions are often characterized by a high indeterminacy with regard to price (Teece, 1981 [12]). This indeterminacy goes beyond the difficulties in assessing the value of intellectual assets (Arrow, 2002 [18]). If the knowledge transfer is accompanied by the supply of related products or services, for example, these additional transactions influence the price of the knowledge itself (Bidault, 1989 [17]). Moreover, compensation is often non-monetary. In particular, it may consist of transferring knowledge in bidirectional knowledge exchanges (Koruna, 2004 [24]). Market imperfections often lead to problems in the *realization of external knowledge exploitation* projects (Elton 2002 [25]). When firms initiate external knowledge commercialization activities, they often need to cope with negative attitudes towards the external exploitation mode among their employees (see the section

n on risks of external knowledge commercialization). Furthermore, knowledge transactions often go far beyond the arm's-length transactions of most product markets (Bidault, 1989 [17]), and companies need to develop the capability of adequately managing these more complex and long-term relations (Kale 2002 [27]). Apart from the capabilities of the company itself, the overall success of such relationships strongly depends on the knowledge customer, e.g. its absorptive capacity, and on the characteristics and similarities of both partners (Lane & Lubatkin, 1998 [28]; Teece, 1981 [12]).

IV. Methodology

The methodology in academic reports aims to provide the readers with a thorough description on what and why specific methods are used to collect necessary data to an article/thesis/report. According to (Collis and Hussey 2009[30]) triangulation research is deemed as a “philosophical framework that guides how scientific research should be conducted. Due to the nature of the report being centered around a specific category of companies with an empirical inquiry on a specific contemporary phenomenon, this study can generally be regarded as a case research. To depict a necessary methodical approach and enhance the overall quality of this report, this master’s thesis has been conducted and reviewed in a way in order to achieve a valid conclusion. Triangulation basically means using multiple sources of data, methods, and more than one researcher to investigate a certain phenomenon and increase the strength of the research. It is clear that research takes a lot of time to comprehend and execute adequately. To avoid confusion you need to conduct research using triangulation approach. (Collis & Hussey, 2009 [30]). As there are different types of triangulation methods, this report uses methodological triangulation and data triangulation. Methodological triangulation implies that more than one method is used to collect and analyze the data. (Easterby-Smith, 1991 [31]) classified triangulation as positivist and phenomenological based on their deductive and inductive orientation. Relating to this thesis, methodological triangulation is used by executing a case study, qualitative interviews and a literature study in order to investigate a certain set of questions. Data triangulation is when data are collected at different times or from different persons in the same study (Easterby-Smith, 1991 [32]). Throughout the case study, data is collected using interviews with key persons related to the case, and analyzing documents/reports related to the case, thus fulfilling the data triangulation. Furthermore, the interviews that are not related to the project in the case study have also been carried out with similar data triangulation approach where different persons from same company were interviewed with a similar set of questions at different time.

V. Research Framework

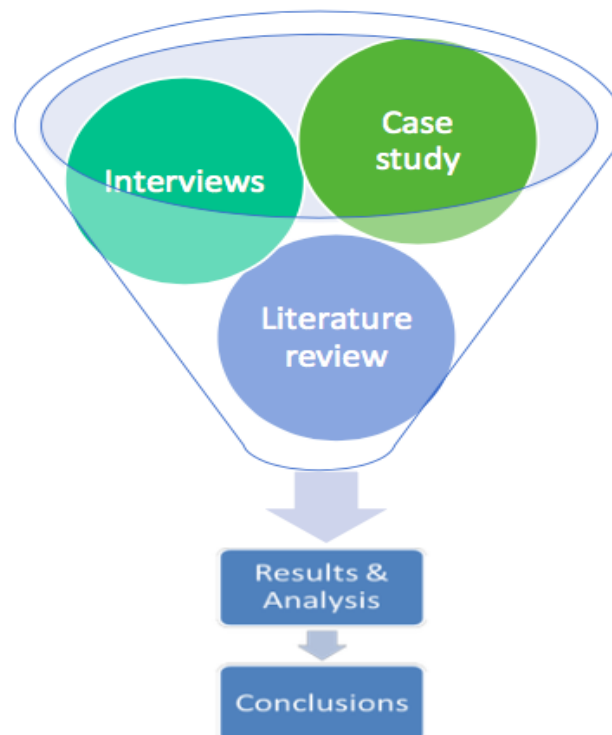


Fig 1. Triangulation approach

Research Hypothesis

[H1] What are the challenges & problems in a planning phase that could occur for an R&D company during external technology commercialization?

Identify and analyze the critical factors.

[H2] How could a R&D company potentially overcome challenges & problems in a planning phase during external technology commercialization?

Identify and analyze the success factors.

[H3] What solutions have been provided by other R&D companies?

Identify and analyze the challenges

VI. Innovation of the Study and Expected Results

As shown, successful R&D alone cannot assure commercial success in areas of advanced technology. Firms must also develop or acquire the capabilities to design, manufacture, and market new products, processes, and services. They must develop complementary technologies needed to make their innovation more useful, and find financing to support their efforts. Numerous barriers can impede the progress of even the most capable firms as they try to introduce new inventions to the marketplace, and numerous firms fail in their attempts. From a national perspective, these lessons are equally valid. While construction of a strong science and technology base is essential to innovation and commercialization, it is not sufficient. Firms must be able to find—within their national innovation systems or abroad—the resources needed to convert new science and technology into a proprietary advantage they can defend in the marketplace. While firms can develop many of the requisite tools themselves, others often lie beyond their control. These needs can often be met through cooperative actions between firms, or between industry and government. Innovation includes not only the development of entirely new products, processes, and services that create new applications, but also the development of new products, processes, and services for use in existing applications (e.g., integrated circuits replacing vacuum tubes in electronic applications), or the use of an existing product, process, or service in a new application (e.g., manufacturers of flat panel displays adapted semiconductor manufacturing equipment to their needs). The empirical findings will be presented and analyzed in reference to the theoretical framework. The empirical findings are mainly related to the interviews and the case study investigated in this research, and related to the thorough literature study. This chapter will be divided into 7 parts; Project initiation, Target setting & Purpose, strategic planning development, technology screening, partner selection and planning tools. There are no strict bounds on each part, and some results could cover several parts. Each subchapter will jointly provide an analysis of the findings of the interviews in research phase 2, case study in research phase 3, and the theoretical framework. Using the systematization developed by Lichtenthaler (2008) [34], the objectives of the project would fall under the technology oriented and mixed categories. No such categorization of the objectives was explicitly formulated which could have hindered the interface between the corporate planning process and the planning processes of the external technology commercialization project. A possible underestimation of the strategic value of categorizing objective was also found among a majority of the interviewees' in research phase 2. In addition to that, few of the interviewees' companies had an explicitly formulated strategy of technology planning. The most common answer to why no strategy is formulated is that the innovation and high technology area is too complex and case dependent to develop a general planning framework. The case study and the interviewees' in research phase 2 both showed that the companies and institutes are aware that the adaptation of their planning processes to a rapidly changing market environment could lead to managerial challenges and collaborative barriers. However, neither the interviewees' in research phase 2 nor the interviewees' of the case study seemed to be aware that certain managerial challenges could be directly linked to the project objectives. As Lichtenthaler (2008) [34] states, aligning overall business strategy with technology exploitation strategies are even more important when companies are running multiple projects which individually could have a different set of objectives. Some of the interviewees' in research phase 2 realized the importance to formulate a cohesive strategy or vision of a project which is in line with the overall company strategy and vision of the senior management. For instance, the director of packaging & logistics from research phase 2 mentioned that an area within the company will improve much more if knowledge from different perspectives and actors are brought together. Cross sectional collaboration is much more common today and companies do seldom apply for single research projects in the way they did more than a decade ago. A complex market environment with extensive knowledge and technology transactions increases the value of networking activities, especially in opportunity enhancing projects which are focusing on reaping the benefits from strategic objectives.

VII. Research Limitations

The paper limits itself to discussing the non- monetary objectives and incentives for engaging in outbound, or in other words, the potential that outbound has in creating strategic business opportunities. The focus of this thesis will be to investigate what eventual challenges and problems are from the perspective of an R&D company/institute/department (etc.) in the process industry, and how they can be solved, rather than an in-depth analysis and/or investigation if the proposed implementations are actually viable financially from an organizational perspective. Furthermore, despite the many opportunities of external technology exploitation and commercialization, there are high risks that require thorough strategic planning and analysis (Lichtenthaler, 2008 [34]). Thereby, the problem statement and research questions are delimited to only regard the planning phase in the five step model, thus other phases and also potential models of similar sort is not accounted for. The planning phase employed in this thesis is also strongly related to a functional perspective. The individual and organizational perspective might occur, but in minor detail and not explicitly, however the background is heavily related to an organizational perspective.

References

- [1]. Lichtenthaler, U. and Ernst, H. (2007). External technology commercialization in large firms: results of a quantitative benchmarking study. *R & D Management*, 37(5), 383-397.
- [2]. MORTARA, L., MINSHALL, T. How do large multinational companies implement open innovation? In: *Technovation*, no. 31, 2011, p. 59
- [3]. Zahra, S.A. and Nielsen, A.P. (2002). Source of capabilities, integration and technology commercialization. *Strategic Management Journal*, 23, 377-398
- [4]. Hung, S.-W., Chang, C.-C., Chen, P.-C. (2011). Technology commercialization in energy-smart industries. *Proceedings of PI CMET '11: Portland International Conference on Management of Engineering and Technology*, 1-9
- [5]. Kutvonen, A. (2011), "Strategic application of outbound open innovation",
- [6]. Brockhoff, K. (1992). R&D cooperation between firms – a perceived transaction cost
- [7]. Caves, R.E., Crookell, H. and Killing, J.P. (1983). The imperfect market for technology licenses. *Oxford Bulletin of Economics and Statistics*, 45(3), 249-267
- [8]. Ford, D. and Ryan, C. (1981). Taking technology to market. *Harvard Business Review*, 59(2), 117-126.
- [9]. Guilhon, B. (2001). How to characterize markets for knowledge? In B. Guilhon (Eds), *technology and Markets for Knowledge. Economics of Science, Technology and Innovation*, 22, 3-20, MA, Boston: Springer.
- [10]. Elton, J.J., Shah, B.R. and Voyzey, J.N. (2002). Intellectual property: partnering for profit. *The McKinsey Quarterly*, Special Edition, 58-67.
- [11]. Sullivan, P.H. and Fox, S.P. (1996). Establishing an out-licensing activity. In R.L. Parr and P.H. Sullivan (Eds), *Technology Licensing: Corporate Strategies for Maximizing Value*. 83-96, New York: John Wiley.
- [12]. Teece, D.J. (1981). The market for know-how and the efficient international transfer of technology. *Annals of the Academy of Political and Social Science*, 458, 81-96.
- [13]. Arrow, K. (1971). *Essays in the Theory of Risk Bearing*. Chicago: Markham.
- [14]. Arora, A. and Fosfuri, A. (2000). The market for technology in the chemical industry: causes and consequences. *Revue d'économie industrielle*, 317– 334
- [15]. Teece, D.J., Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 509– 533
- [16]. Bidault, F. (1989). *Technology Pricing: From Principles to Strategy*. New York: St Martin's Press.
- [17]. Arrow, A.K. (2002). Intangible asset deployment in technology- rich companies: how does innovation affect return on assets? *International Journal of Technology Management*, 24(4), 375-390
- [18]. Koruna, S.M. (2004). External technology commercialization - policy guidelines. *International Journal of Technology Management*, 27(3), 241-254.
- [19]. Elton Ernst, H. (2002). Success factors of new product development: a review of the empirical literature. *International Journal of Management Reviews*, 4, 1– 40.
- [20]. Kale, P., Dyer, J.H. and Singh, H. (2002). Alliance capability, stock market response, and long-term alliance success: the role of the alliance function. *Strategic Management Journal*, 23(8), 747-767.
- [21]. Lane, P.J. and Lubatkin, M. (1998). Relative absorptive capacity and interorganization-al learning. *Strategic Management Journal*, 19(5), 461-477
- [22]. Teece, 1981 [12]. Teece, D.J. (1981). The market for know-how and the efficient international transfer of technology. *Annals of the Academy of Political and Social Science*, 458, 81-96.
- [23]. Collis, J. & Hussey, R. (2009). *Business research: A practical guide for undergraduate and postgraduate students*. Palgrave Macmillan.
- [24]. Easterby-Smith, Mark, Thorpe, Richard, & Lowe Andy (1991), *Management Research. An Introduction*, Sage: London
- [25]. Lichtenthaler, U. (2008). Opening up strategic technology planning: extended roadmaps and functional markets. *Management Decision*, 46(1-2), 77

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