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The French defence industry in the knowledge management era: A historical overview and evidence from empirical data

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ABSTRACT

In the defence industry the recent development of a 'market for technology', the creation of new European high-technology companies as well as transformations in government agencies have driven firms to reposition their technological and organizational skills. Our objective is to show that the transformations that have occurred in the past 10 years have not only redefined skills and the organization of production, but also have given a more strategic place to knowledge management (KM) practices. We provide a contextual and historical overview based on qualitative interviews, in order to better understand the relation between KM and innovative behaviour in this industry. We build an original industrial and technological database comprising various samples that provides quantitative information concerning KM and innovative practices. The results of the statistical analysis reveal the specificity of firms in this industry. Taking account of the size of these firms and their technological intensity, we show that the behaviour of defence industry firms in terms of KM practices, differs from that of other firms. This is evident from their technological performance, and innovation and patenting intensity. This structural tendency is explained as an innovative behaviour in the French national innovation system rather than merely a 'trend'.

1. Introduction

In 1997 the French defence industry underwent a major transformation following the government's decision to reduce budgets and manpower in this domain. This reduction in the funds dedicated to defence has generated a break from 'capitalism à la française' and a remarkable reconfiguration of government agencies and firms (Serfati, 2001; Mustar and Larédo, 2002; Guichard, 2005). In the same year, the 'national champions' underwent a process of privatization and Europeanization of their organizations, and a redefinition of their knowledge base. The French defence industry is not unique in having experienced such a transformation; some years earlier, the British defence industry was subjected to similarly drastic changes with the emergence of more competitive markets (Avadikian and Cohendet, 2005; Dowdall, 2004; Molas-Gallart and Tang, 2006).

These changes, which have resulted in the creation of new European high-technology companies, could have been used as an opportunity for creating new industrial architectures and for developing new capabilities (Jacobides et al., 2006). However, the specific environment of the defence industry as well as the division of labour and technological skills that prevailed before these transformations, limited the scope of these opportunities (Acha and Brusoni, 2008). Moreover, in an era of resource depletion, the reinforcement of organizational capabilities enabling firms to better identify technological know-how and its future development appear to be critical. Consequently, knowledge management (KM) practices have become an integral part of innovative strategies (Coombs and Hull, 1998; Foray and Gault, 2003; Kremp and Mairesse, 2003; Guillou et al., 2005) to better explore the firm's future development.

Although, at first sight, KM practices might seem contradictory within the tradition of secrecy that has prevailed in the defence industry, our qualitative study reveals a different picture: government agencies and firms have a long tradition of formalizing and articulating their know-how in order to be able to justify their technological options and to guarantee the traceability of past projects (Majchrzak et al., 2004). Our interviews show that firms have had KM policies in place for some time, but that they have not been explicit or generalized and, consequently, have not been widely diffused. Thus, the development of KM practices was seen as providing a way of coping with the scarcity of resources and increasing the value of the knowledge base.

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However, KM practices and their wide diffusion is a new tendency in the French national innovation system (NIS). As already mentioned, firms are facing these challenges within a new institutional context (Serfati, 2005). In addition, the diffusion of electronics in both weapons systems and command and control networks has provoked a significant rupture with the diffusion of a new technological paradigm, and has created new links between civil and military products (Dowdall et al., 2004). In this perspective, KM programmes have evolved gradually, to become a strategic component of innovative policies and to play a critical role in managing knowledge. Moreover, as no organization on its own can manage all the knowledge that is necessary for the design and realization of systems and sub-systems, knowledge integration and knowledge coordination have become vital for firms in this industry (Grant, 1996; Hobday et al., 2005; Acha and Brusoni, 2008).

This paper is organized as follows. Section 2 outlines the theories and goals of KM and discusses the specificity of the French defence industry. We show the key role played by some government agencies in promoting KM practices and in repositioning know-how and skills within the NIS. Section 3 deals with methodological and statistical issues in the elaboration of an original French data sample to provide an accurate empirical picture of the impact of KM policies in firms, in relation to their innovative behaviour. The impact of KM practices on performance is also discussed. We conclude with some pointers to the originality of our research and proposals for topics for further research.

2. KM practices in the defence industry: the state of the art in the French NIS

KM practices in the defence industry[1] cannot be understood outside of their institutional and historical context, which has created strong path dependencies. Although both firms and government agencies have participated in the diffusion of KM practices, their goals and objectives remain quite distinct. We will explain this complementarity and show why firms in the defence industry use KM practices as a means of reinforcing their innovative positions. Based on a review of the literature we show the relation between KM practices and R&D policy. Using stylized facts based on our qualitative interviews we elaborate hypotheses related to KM practices and their emergence.

2.1. KM: definition and goals in the defence industry

Recently, much attention has been paid to policies related to KM to identify and preserve technological skills and to shed light on organizational capabilities. KM practices mostly involve R&D, innovative policies (Coombs and Hull, 1998) and the search for medium and long-term performance (Kremp and Mairesse, 2003).

Knowledge management (KM) covers any intentional and systematic process or practice of acquiring, capturing, sharing and using productive knowledge, wherever it resides, to enhance learning and performance in organizations. These investments in the creation of 'organizational capability' aim at supporting – through various tools and methods – the identification, documentation, memorization and circulation of the cognitive resources, learning capacities and competencies that individuals and communities generate and use in their professional contexts. Practices, like formal mentoring, monetary, or non-monetary, reward for knowledge sharing and the allocation of resources to detect and capture external knowledge, are examples of knowledge management (Foray and Gault, 2003: 12).

KM policy is a way of preserving knowledge and of focusing attention on crucial know-how: tacit, codified or articulated (i.e. know-how embedded in human minds, knowledge articulated in the form of patents, knowledge codified in various ICT tools). The degree to which the articulation and codification are adopted by organizations can differ radically, depending on the costs and benefits for the particular firm, its strategic vision and the importance attributed to the development of capabilities (Teece, 1998; Zollo and Winter, 2002; Lazaric et al., 2003; Denrell et al., 2004).

In the defence industry, a related issue refers to the traditional decision between spin-off *vs.* spin-in, as in the digital age, R&D and technology are no longer dedicated to but rather are adapted for military uses (Stowsky, 2004). In this context, the duality of knowledge may generate transformation of the know-how for various uses (civilian and military), and may create opportunities for its recombination, particularly in the case of complex products and systems (CoPS). On the other hand, firms and government agencies need to develop new organizational and technological capabilities 'to define and combine all the necessary inputs for a system and agree on path of future systems developments' (Hobday et al., 2005: 1110). These 'integration capabilities' are necessary for various reasons. First, because the distribution of knowledge is not always concomitant with the division of labour and in some cases 'firms know more than they make' (Brusoni et al., 2001). Second, in order to achieve really dynamic coordination, knowledge management must be consistent with the objective of innovation and of development of a broad knowledge base capable of providing the input necessary for the design and development of technologies within the firm, or in collaboration with external partners. New types of relationships among various organizations are required therefore, for the purposes of knowledge development and preservation, even though this objective might seem not to equate with KM related objectives.

To be more explicit, according to Grundstein (2001), we can draw a distinction between two major objectives in KM. Firstly, KM can be oriented to a long-term purpose and to the accumulation of large depositories of knowledge (in the nuclear and space sectors, this need for exhaustive data can be extremely critical in order to avoid technological disasters). Secondly, knowledge can be preserved to fulfil an 'innovative objective'. Here, there may be a short-term perspective and the knowledge acquired through past products and projects can be used for the development of new ones (Argote, 1999; Majchrzak et al., 2004). This is certainly the most frequent KM policy goal.

Grundstein's distinction of the objectives of KM policies is relevant in the French context, where government agencies have clearly evolved over a long time frame in terms of knowledge preservation policies, whether oriented to the past, the future or both (Grundstein, 2001). The problems confronting these government agencies include the need to provide collective pre-competitive knowledge, and to ensure its longevity of knowledge in the context of the French NIS (Papon, 1998; Mustar and Larédo, 2002). For government agencies, the preservation of know-how related to military uses is a sensitive issue. This explains why the French Atomic Energy Commission (CEA) has implemented significant initiatives paving the way to experimentation in this field.

[1] Generally the defence industry is defined by the characteristics of its products or services. For a discussion, see Dowdall (2004: 538) who emphasizes the practical difficulty of applying this concept to a multi-products organization context. The scope of this industry is broad and rarely confined to strict defence products, but can include field like such telecommunications, hydroelectric and nuclear power, public utilities, etc., ... For this reason, in this article, 'defence industry' includes all those firms that are direct suppliers of Defence Ministry and implement R&D (see Section 3 for details). This definition allows for the fact that 'governments are central to understanding defence industries' (Hartley and Sandler, 2001, in Hartley and Sandler (eds.); see also Hartley, 2006).