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Impact of entrepreneur on the sectoral system of innovation: Case study of the Indian crude oil refining industry

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ABSTRACT

In this paper using the connectionist perspective of an entrepreneur we have tried to highlight the importance of the entrepreneur and the role of the entrepreneur in initializing and crystallizing the sectoral system of innovation. Using evidence from the Indian crude oil refining industry we show how the technology strategy of entrepreneur was widely replicated by other producers in the industry, clearly indicating the technology foresight shown by the entrepreneur. The strategies of the firms in the industry combined with government incentive and stringent fuel regulations helped the Indian crude oil refining industry attain international competitiveness.

1. Background

Having gone through at least a couple of foreign exchange crises, India, understands the importance foreign exchange. It requires foreign exchange not only to import a bulk of the crude oil it processes but also for other important imports. Industries that export goods are thus encouraged by the government not only for their important role of earning foreign exchange but also for their contribution in generating employment in the country. Firms that intend to export their goods need to be internationally competitive, which in simple terms implies that they need to develop an ability to compete with their foreign counterparts. The petroleum refining sector in the country has done remarkably well in the past many years, so much so that it is one of the largest foreign exchange earners for the country. From being in the negative territory till 2000–01, net product exports, both in terms of quantity as well as dollar value, has shown an increasing trend till 2011–12. This makes it clear that there has been a transformation in this sector which has helped it to become internationally competitive. There are numerous factors that have helped the sector attain international competitiveness. In this paper, we try to analyse and understand the gradual transformation of the refining sector in India by highlighting the importance of the entrepreneur, particularly the technology foresight and other strategies, in crystallizing the sectoral system of innovation for the refining industry in India. We use the connectionist perspective in highlighting the role of the entrepreneur. Using the sectoral system of innovation framework, we show that the technology choices made by the entrepreneur are now being widely followed by firms in industry.

The concept of sectoral system of innovation and production was introduced and defined by Malerba (2002) as a set of new and established products for specific uses and a set of agents carrying out market and non-market interactions for the creation, production and sale of those products. This paper tries to add to the existing literature on evidence of sectoral system changes by mapping out the changes in the petroleum refining industry in India that helped it attain international competitiveness. The petroleum refining industry is particularly interesting because there was a remarkable improvement in the competitiveness of this sector after the entry of a private player in the sector. As we show, the entrepreneurial activities

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including the technology foresight of the private player played a critical part in initiating and sustaining the sectoral system of innovation. Thus this study will also help us understand better, in the context of a developing country, the importance of firms in the sectoral system of innovation and the effects of their actions on other firms in the sector. The paper is arranged as follows: in Section 2 we note the important characteristics of entrepreneur, innovation and competitiveness, and in Section 3 we describe the sectoral system of innovation and its usefulness in addressing the research question at hand. Section 4 will describe the refining sector in the country, while Section 5 describes the role of the entrepreneur which in our opinion crystallized the sectoral system of innovation. Section 6 applies the sectoral system framework to the refining sector in the country followed by the concluding section.

2. Entrepreneur, innovation and competitiveness

As per Schumpeter an entrepreneur is an innovator who thinks up ways of putting scarce resources to new uses, for example — by introducing new ways of producing goods, by opening up new markets as well as new sources of supply of raw materials, to name a few. Earl (2003), in his connectionist perspective on entrepreneurship notes that entrepreneurs do have original creative thoughts about what might form the basis of a business project, and these entail making connections. Entrepreneurs differ in terms of the mental ingredients they employ and also in their tendencies to experiment mentally with making new combinations. They may also be more willing to take risks because they do not construe hazards as others see — either due to simply not thinking in terms of particular dimensions, or because they have extra thought dimensions in certain areas that lead them construe wider opportunities than others for gain and for managing problems. Mere possession of a range of technological capabilities does not guarantee success in projects, for someone must first notice the potential connections and overcome any barriers to making them happen. Thus an entrepreneur may be someone with an eye for what will fit from other people's competencies. Entrepreneur is in the role of someone with a comparative advantage in making connections between product elements, products, capabilities and cost/revenue streams. The connection-making entrepreneur is thus an agent whose disequilibrium creating actions opens up opportunity sets in the manner envisaged in Schumpeter's work. By making novel, previously unimagined connections, the entrepreneur creates new elements from which yet further sets of combinations can be made, leading to economic growth.

Castellacci (2008) points out that evolutionary economics conceives innovation as a paradigm-bounded, sector-specific and context dependent activity. The paradigmatic nature refers to the existence of dominant technological paradigms that create, in any given historical era, a set of opportunities and constraints for innovative activities. In the evolutionary view, the impact of innovation on the international competitiveness of industries must therefore be analysed within a complex framework comprising both, the broader systemic context shaping innovative activities, and the sectoral specificities that characterise the creation and diffusion of knowledge. This paper also states that innovative firms follow distinct strategies in different sectors of the economy, and it has been shown, in particular, that the innovative process in traditional and low-tech sectors is based on a variety of different strategies, such as the acquisition of capital equipments and machineries that embody advanced technologies, rather than on formalized R&D activities.

The refining industry with respect to its technological cycle is considered to be a traditional or mature industry. What we intend to explain in this paper is that how the technology foresight of an entrepreneur and the strategies it followed crystallized the sectoral system of innovation in the Indian petroleum refining industry. The entrepreneur in the Indian petroleum refining industry followed a variety of different strategies, such as the acquisition of capital equipments and machineries that embody advanced technologies to attain international competitiveness, which was then followed by another private firm. Since evolutionary economics emphasises the context-specific nature of innovative activities, it is relevant to look at the broader systemic context within which the innovative process unfolds and not only the structural characteristics defining the industry-specific technological regime. This, we feel is best carried out under the sectoral system of innovation framework.

3. Sectoral system of innovation

The concept of sectoral system of innovation and production was introduced and defined by Malerba (2002) as a set of new and established products for specific uses and a set of agents carrying out market and non-market interactions for the creation, production and sale of those products. This sectoral system has a knowledge base, technologies, inputs and — an existing, emergent, and potential demand. The agents in the sectoral system are organisations and individuals. Organisations may be firms and non-firm organisations, including sub-units of larger organisations and groups of organisations. Agents are characterised by specific learning processes, competencies, beliefs, objectives, organisational structures and behaviours. They interact through processes of communication, exchange, co-operation, competition and command. The interactions among the agents are shaped by institutions or rules and regulations. This seminal paper also mentions that over time, a sectoral system undergoes processes of change and transformation through the co-evolution of its various elements. Malerba (2005) identifies the three main building blocks for a sectoral system as: knowledge and technology, actors and networks, and institutions. Each sector in an economy creates its own knowledge base which differs across sectors; this is not to say that the knowledge base in each sector of the economy is completely different from the knowledge base of the any other sector of the economy, which clearly is impossible given the overlapping nature of knowledge. There are fields, for example instrumentation in engineering, whose knowledge base as well as the technology it has developed is applied across various manufacturing sectors. Depending on firms, technology of producing a similar product may change within a sector; Malerba (2005) acknowledges that knowledge and basic technologies constitute the major constraints on the full range of diversity in the behaviour and organisation of firms. Thus knowledge and technology form an important block of the sectoral system. The second building block of the sectoral system i.e. actors and networks, basically consists of heterogeneous

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