# Activating NSI: introducing the concept of innovation circle in the Enterprise Innovation System (ESI)

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**Abstract**

National System of Innovation (NSI) is a powerful concept that has extensive influence on S&T policy research for last four decades. The present article re-examines the concept of NSI, and suggests that the concept does not have any internal dynamics that activates NSI. With reference to the disconnect between the production system and the innovation support system in Indian NSI (as underscored in the Indian National Innovation Survey), the article suggests that the trigger that can activate the NSI is the demand from the enterprises. The focus, therefore, should be on the Enterprise System of Innovation (ESI); the micro replica of NSI. The article introduces the concept of Innovation Circle as a mode of inculcating the culture of innovation with in an enterprise, thereby stimulating demand and activating NSI.

**Keywords**

National System of Innovation, Enterprise System of Innovation, Innovation Circle, Culture of Innovation.

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## Introduction

Fagerberg and Sapprasert [1] observed a trend break in late 1980s and early1990s in the literature on innovation with change in focus from firm as unit of analysis to 'stronger emphasis on the interdependencies between the actors, organizations and institutions that influence the innovation and — above all — was much more focused on policy', that is National System of Innovation (NSI).

NSI is a powerful concept that reveals the importance of 'system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies' (Metcalfe) [2]. In order to promote innovation, the different innovative actors must have strong linkages with each other based on a strong level of trust. Governments should oversee to promote and activate trust among the different innovation actors (Chung) [3]. Furthermore, the success factors of NSI have been seen by many scholars in the creation of supportive institutions and organizations (with a key role of education) and collaboration linkages Bridging Scales in Innovation Policies throughout the various elements that constitute an NSI (Fromhold-Eisebith) [4]. Works of Nelson [5], Freeman [6], Lundvall [7] and others such as Kline and Rosenberg [8] helped open the black box of innovation, understanding of which before that remained a linear flow from R&D. The NSI reveals that innovation results out of a set of institutions whose interactions

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determine the innovative performance ... of national firms (Nelson). In a study on Health Bio-technology Innovation System in India Arora [9] reaffirms that both national and international linkages are equally important. An innovative firm's technological capability evolves through internal efforts, while learning from international best practices and augmented by the emerging public-private partnership.

It is to be noted that NSI as propounded by the trio ( Freeman , Lundvall, and Nelson) begins with the innovation  end of the problem. Or, in other words, investigation traces institutional interactions that make innovations happen. The opposite of it, however, is not obvious. Since there is no benchmark of nature, extent and intensity of interactions among types of institutions, we do not know the ideal types of institutions and types of interactions among them that would ensure innovations.

The fallacy embedded in the formulation of NSI is that any type or intensity of interactions and types of institutions are **good** if those are related to a **successful** innovations. It is, therefore, post-facto understanding of innovation dynamics. Questions remain what, who and how such interactions are triggered? The relevance of the question emanates from one of the major findings of the National Innovation Survey on India [10].

The survey suggests that there are wide range of institutions as part of innovation support system, but there is a discernible disconnect between the innovation support system and the production system. The interactions among different institutions that NSI talks about is largely absent in Indian scenario. From this perspective the question that arises - what is it that triggers or activates close interactions and resulting learning and actions of wide range of national institutions? We propose that the trigger is inside the enterprise where innovation happens. In an innovation active firm there would be need/demand for various types of supports to be sourced internally and also from external agencies. Let us name

this process as 'Innovation Circle'. We propose that making innovation happen is making/activating 'innovation circle' in a firm. We see innovation as an ongoing activity with in a firm. 'Innovation Circle' is a construct to give a body to interactions and actions that result to innovation. To this end we revisit 'firm', where a firm is seen as a 'coordinator'. Accordingly, firms' innovation can be seen essentially as a set of actions and functions that activates innovation in a firm. We identify 'innovation circle' in an innovative firm as the defining dynamics of innovation that create demand on the innovation support system.

We build up the argument in the subsequent sections. In section-1 we restate the innovation ecosystem as elaborated in the literature for firms becoming innovation active. The market dynamics and driver for innovation active firms is elaborated in section 2. We define the functionality of the Innovation Circle, and make a distinction between 'production capability' and 'technological capability' of a firm in Section-3. The discussion is rounded off in section – 4.

## 1. Innovation active firms

By innovation active firm we mean firms in pursuit of technological competition as opposed to price competition. While technological innovation is a way towards strengthening market power, the debate on conditions that make a firm invest in activities fostering technological innovation has generated important insights into theory of firm.

Literature on technological innovation of firm is a direct off-shoot of Schumpeterian description of capitalism and its dynamics. Technological innovation is a way to build technological capability that enables a firm beat price competition with technological competition. Firms that have market power and are resource rich can afford to go for technological competition. Nath [11] has detailed the above postulates as Schumpeterian

sufficient condition (Market power and the economic rent accruing from it is the Schumpeterian condition for a firm investing in technological innovations.), and Galbrathian [12] necessary condition (Present day technological innovations require large resources. Only large firms can mobilise large resources for technological innovation.) for a firm investing on technological innovations. These conditions are about market power and availability of resources that enable large firms to go for technological competition as opposed to price competition. Arrow [13] added the incentive aspect to innovation to suggest that if monopoly is defined as barrier to entry, 'incentive to invent is less under monopolistic than under competitive conditions but even in the latter case it will be less than socially desirable'. Arrow also suggested that appropriability is the only argument in favour of monopoly power as sufficient/necessary condition for innovation. A monopolist is likely to be the 'first second' as innovator (Baldwin and Childs) [14]. Even in a competitive market condition, according to Arrow, inventions would be essentially cost reducing as opposed to radical innovations. Focusing on market structure, Philips suggested that in a market dominated by a few large firms coexisting with numbers of small firms, higher market concentration might inhibit technology competition through tacit market sharing among large firms. On the other hand, small firms in the same market operating in a competitive condition might be more innovative for creating their own market niche.

As such, therefore, there is no apparent incentives for firms undertaking radical innovations. Arrow suggested institutional intervention for creating incentives and conducive conditions for radical innovations leading to technological competitiveness. NSI, as discussed above, highlights this aspect of institutional arrangements for

innovation. The question, however, remains about the dynamics between market and firm that nurtures the transformation from price competition to technological competition.

## 2. Driver of Innovation Active Firm

We ask the same classical question, 'What is a firm?' A firm may be seen as a 'black box' "consisting of a set of production activities or even a presumed production function with a finite set of inputs to be adjusted so-as-to generate a set of outputs corresponding to a maximal level of profits or some other measure of owner utility. The inputs controlled by the firm are then assumed to be put to their most efficient use without having a look "inside" the firm or "outside" in the relations with other economic agents, excepting for competition with other firms." (Andersson, Johansson )[15].

Coase [16] observed that firms and markets are alternative institutions. He "pointed out that in addition to production costs of the usual sort, one must also consider transaction costs inside and outside of the firm in explaining institutions such as a firm. He focused on the comparative transaction costs of alternative organizational structures, such as firms and markets." Market may fail to provide right inputs at right time and place; may not offer desired most efficient use of the inputs. Hence is the firm that makes effort to keep inputs under control and works on efficient use of them. In the process firms incur cost which is known as transaction cost. Williamson [17] argued that market failure is the source of transaction cost. This was later extended by Williamson [18] to be known as transaction cost economics or more broadly the economics of organization. Firm, therefore, treated as an organization. Because of asset specificity and bounded rationality (limited cognitive ability) certain transactions have to be executed away from market. This is the beginning of organization. Transaction cost is the cost incurred for avoiding market, and operating in network mode. In Williamson it is the undesirable evils of modern market system.

Lazonick [19] has given it an interesting twist. He postulates that acting within organisation and acting away from the market are intended acts of value creating capitalist firms. Lazonick made a distinction between 'adaptive' enterprise and 'value creating' enterprise. According to Lazonick a capitalist enterprise is a value creating enterprise, the basic dynamic of which is to create competitive advantage by developing enterprise specific assets; both physical and human. Transaction cost, therefore, is not an undesirable evil; on the contrary it is incurred as an intended act for developing asset specificity. Lazonick brands a Williamson type firm as adaptive enterprise. Further, Lazonick makes a distinction between 'market coordinated' and 'organization coordinated' enterprises. According to Lazonick a value creating enterprise is necessarily 'organization coordinated' since its basic dynamics is to create asset specificity. On the other hand, an adaptive enterprise is market coordinated, where transaction cost is a fait accompli – evil of market failure.

So, the evil of Williamson's asset specificity and bounded rationality that subject the firms to undesirable transaction cost, becomes the basic dynamics of a value creating firm in Lazonick. The firm creates asset specificity for gaining competitive advantage, and brings in human resources to allay the limitations associated with bounded rationality.

Once enterprise specific assets are created by an enterprise the same does not remain specific for all future time to come. The advantage created by an enterprise is emulated or imitated by others in the business. A diffusion process begins. Over a time period the specificity will not remain an advantage to the initiator enterprise. It has to look for new specificity and create new advantage. What happens to the assets that have become common advantage of the industry? Instead of going for endless accumulation of assets of different vintages the enterprise would externalize activities associated with those

assets and would adopt market coordinated transactions for them. Every enterprise will, therefore, have both organization coordinated and market coordinated transactions. This process of moving from organization coordinated to market coordinated transactions is associated with the process of creation of asset specificity and gradual termination of the same over a period of extractable competitive advantage from the asset specificity. We, therefore, can describe the dynamics of Lazonick's value creating enterprise as a process of creation and termination of asset specificity. Innovation, therefore, can be seen as firm specific asset embodied in physical and human assets.

Value creating enterprise may, therefore, be called innovative enterprise. If innovation is defined as new knowledge being used by an enterprise, and considering knowledge as asset embodied in physical and human assets, such an enterprise will create enterprise specific knowledge. This is Enterprise System of Innovation (ESI). The Innovation Circle (IC) is the way ESI gets activated within.

### 3. Inside the organisation of an innovation active firm

A firm produces an artefact. The artefact is the reflection of the technological knowledge it possesses. So, we say that the firm has the technological knowledge for production of an artefact. Pavitt [20] has suggested '---distinctions between the artefacts (products, etc.) that the firm develops and produces, the firm-specific technological knowledge that underlies its ability to do so, and the organizational forms and procedures that it uses to transform one into the other' should be used for analysing the innovating firm. Following Nelson [21], Pavitt identified two complementary elements in firm specific knowledge; 'body of understanding' and 'body of practice'. Pavitt has quoted from a study by Iansiti and Clark [22] to illustrate the distinction between the two forms of knowledge.

We shall use the same illustration of body panels of automobiles for developing our argument on deconstruction of knowledge. Let us digress here for clarification on deconstruction of knowledge by an enterprise.

In a deconstructed form this knowledge includes, for example '--- knowledge of techniques of die design, die modelling, die testing and finishing. Additionally, knowledge can take the form of the skill of die designers in anticipating processing problems, customised software that allows for rapid and effective testing, patterns of communication and informal interaction between die designers and manufacturing engineers that allow for early identification of potential problems, an attitude of co-operation that facilitates coordinated action between die designers and the tool makers that will build the dies. These elements (and many others) define an organizational capability for die design and development' (Iansiti and Clark). This knowledge is embodied in various types of physical and human assets and they are made to function in a defined fashion through an appropriate organizational arrangement. This organisational arrangement of vertical diffusion of knowledge can be named as Innovation Circle. It is within this structure that knowledge is accumulated, stored, and many related additional innovations take place. Such innovations are, following Rosenberg, incremental improvements on existing innovations based on past experience (Rosenberg) [23].

For any firm acquiring a technology without the above mentioned organisational structure (lets call it Innovation Circle) in place will at best lead to attainment of some 'production capability' and not 'technological capability' as distinguished by Bell and Pavitt [24, 25]. This attainment of production capability, (which may be called horizontal diffusion of technology), without Innovation Circle does not make a firm innovation active. Following Coase we say, if a firm is seen as coordinator, the Innovation Circle

activates that role - the flow of information, and generation of knowledge through processing of information within the firm. Hayek [27] emphasized the role of information in the coordination of economic activities. According to Cassan [28] "essence of coordination is decision making", and suggested an information theory of firm. Choo[29] added to suggest that information for decision making is a traditional perspective of use of information. According to Choo **organization** is a sense making body and it performs that job by accessing and processing information for knowledge creation. A modern firm is no longer a stand-alone producing entity. It actually operates in a network mode; networked with hundreds of globally distributed nodes for accessing and processing information for knowledge creation. Nonaka and Takeuchi [30] prefers to describe it as knowledge creating firm.

## 4. Rounding off

Enterprise innovation System or ESI, following the NSI, can be constructed as a system of interactions and coordination among different units of an enterprise. In a formal structure, information gathered through such interactions have to be well coordinated and processed for decision making. Let's call an organizational structure inside an enterprise performing this job as 'Innovation Circle' (IC). IC is conceptualized as a mode of intra organizational communication network among interdependent work units relevant for building technological capability and also being associated with both national and global networks towards attaining higher levels of technological capability, competitive advantage and growth.

Findings of the DST Reports on NSI and related other studies when seen in the light of the above discussion, suggest that the disconnect between the production system and innovation support system can be explained by the fact that Indian firms in those studies

are generally ‘adaptive’, ‘market coordinated’ and geared to attaining ‘production capability’ as in contradistinction to the firms that are ‘organisation coordinated’, ‘value creating’ and geared to attaining ‘technological capability’.

We propose that in the context of recent thrust towards global footprint of Indian enterprises through promotion of technological innovations, the Innovation Circle mode shall help in inducing or stimulating an innovative culture for enterprise to be on continuous value creating curve.



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