Patterns of Collaborative Innovation in the U.S. Telecommunications Industry after Divestiture

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Introduction

309 This article discusses the role of institutional change as a determinant of innovative behaviour in the U.S. telephone service industry. We are concerned with a particular evolutionary path of technological development, i.e., the pattern of innovations which occur through inter-firm collaborative activities[1].

The purpose of this paper is to show that certain aspects of the institutional organization of the examined industry have provided incentives for collaborative innovations and have focussed them in specific directions.

From this perspective, an extension of the «bottleneck approach» is suggested. This approach was first introduced by Rosenberg[2] in a different context to explain the rate and direction of technical innovation.

310 Two qualifications are needed here. First, it is argued that looking at compelling constraints may be useful also when examining patterns of collaborative innovation. Collaborative ventures are a way by which firms can tackle those constraints that they consider the most compelling ones at a given moment in time. The second specification suggested is the point that an important set of factors affecting the decision to innovate in specific directions is represented by institutional constraints and regulatory measures.

Institutional changes may themselves act as focussing devices, stimulating firms' *innovative reaction*. An institutional constraint does not only limit a firm's area of activity; it may stimulate an effort to find a way around through the (cooperative) creation of new value generating activities.

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[1] Collaborative modes of innovation have been discussed be Teece (1986), Rosenberg (1987), Mowery (1988), Hagedoorn (1990)

[2] 1976

Reference to the U.S. telephony industry is particularly appropriate for the analysis of the above mentioned issues. Collaborative ventures appear to be a fundamental vehicle for technological change. Moreover, the examined industry has experienced a deep institutional change which has affected firms' decision making processes and induced an intensification of collaborative activity and focussed it in specific directions.

Institutional change is not the only, nor necessarily the most relevant, underlying dynamics explaining the rate and direction of collaborative innovation. The diffusion of microelectronics and of other horizontal and complementary technologies has also induced a growing need for inter-firm collaboration[3].

311 Restriction to institutional organization as a driving force for industrial transformation does not imply that institutional change is totally independent of technical and other environmental evolutions. They are inextricably linked.

II. Institutional Evolution and the Structure of the U.S. Telephone Industry

The U.S. telephone sector consists of two groups of players. There are the seven Regional Holding Companies (RHCs), which spun-off from AT&T in 1984. These firms serve approximately 78% of 127 million U.S. local households. The remaining share is covered by about 1400 «Independent» Companies, not bound by the 1984 *Modification of Final Judgement*.

312 The two groups of actors face significantly different institutional provisions, the former being considerably more constrained than the latter. There are two chief institutional constraints on RHCs' activities: (a) constraints on diversification and (b) constraints on the organization of R&D. These constraints create greater incentives for RHCs to engage in collaborative activities and focus their cooperative behaviour in directions significantly different from those followed by Independent Companies.

313 Evidence concerning collaborative innovation of the U.S. telephone service sector (using the Predicast Database) shows that, over the January 1984 - December 1990 period there were 546 agreements involving the seven RHCs and the six largest

[3] Teece, 1988

Independent Companies. A minor share of the considered partnerships occur between the two groups of firms (2-3%), or within the groups (4-5%).

Most collaborative ventures thus represent a way by which individual firms belonging to either category interact with external parties operating in fields that are different from the original lines of business.

The total number of new agreements recorded in the industry as a whole has steadily increased over time. Moreover, the share of innovative agreements has considerably grown over time[4]. This is particularly the case of RHCs, that have more than doubled the number of innovative agreements from 1984 till 1990.

III. The Effects of Diversification Constraints on Collaborative Activities

314 If diversification is constrained, cooperation may be an effective way to by-pass the constraint itself. In the case of RHCs, the constraint was imposed by institutional changes and it appears to have reduced the potential of exploitation of economies of scope.

- Network Modernization Agreements

315 The constraint imposed on diversification has focussed the RHCs' attention on the problems of network modernization. Such problems existed before the introduction of Line of Business Restriction; however, their implementation changed the RHCs' perception about the urgency of upgrading their network.

317 RHCs tend to get involved the most in collaborative activities with a purpose of either diversifying services or upgrading their network.

- International Joint Ventures

318 International joint venturing appears to correspond more to the aim of exploiting economies of scope which cannot be realized in the national market.

[4] When using press information it may be sensible to adopt the following criteria to provide a broad definition of innovativeness. First, all partnerships reported to involve some joint R&D activities are included in the «innovative agreements». Second, partnerships aiming to jointly produce services or goods which did not originally belong to at least one of the partners' portfolio, also have some degree of innovativeness. Third, info concerning supply agreements included cooperative ventures involving new product/service trials, as well as the upgrading or adaptation of existing equipment. These are also thought to present some innovativeness.
Pure supply agreements and pure marketing agreements are excluded from the innovative agreements category.

319 Data from the Predicast database shows some evidence on the «preference for international joint ventures» on the RHCs' side.

- Diversification at Independent Companies

Independents have a lower involvement in network upgrading cooperative activities, due to the fact that Independent Companies' networks have already been highly modernized.

IV. The Effects of R&D Constraints on Collaborative Activities

320 Even an increase of the proprietary part of Bellcore's budget and some individual effort on the side of single RHCs would not guarantee a more competitive presence on the market. The RHCs' total R&D budget does stand at a very high monetary level.

321 However, the R&D/Sales ratio provides a different picture: it is 1,5% for RHCs as opposed to FT's 4,1%, NTT's 3,8%, BT's 2% and GTE's 1,6%. Moreover, the monetary value of RHCs' research efforts remained constant in the 1984-1987 period.

V. Some Conclusions and Generalizations

322 Cooperation can provide a relatively easy solution to the compelling constraints a firm encounters

323 However, as GTE's experience shows, cooperative activities imply organizational cost and may themselves generate new problems and difficulties, which the firm is unable to face. Cost of cooperation can exceed benefits.

Two areas of institutional evolution appear to play a critical role in shaping firms' cooperative activities in several industrial contexts. The first area identifies those institutional factors which affect firms' possibilities of exploiting diversification opportunities and influence economies of scope. The second area refers to institutional provisions influencing the vertical organization of firms, particularly R&D-producer-user liaisons.

Institutional measures affecting diversification will influence collaborative activities also in other industries, especially those characterized by a highly flexible technological structure.

In a sector characterized by a high technical complexity, the regulatory framework affecting R&D-manufacturers-users integration generated new needs for cooperative ventures. Interactions with users appear to be an essential asset for post-commercialization innovative performance.

Looking at institutional constraints, particularly referring to diversification and R&D organization, may help understanding the intensity and direction of collaborative agreements as a vehicle for innovation in different industries.

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