Intellectual property rights, strategic technology agreements and market structure
The case of GSM

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□ Introduction

- The notion of the knowledge economy implies that knowledge has become a firm's primary means of generating profits.

- Analyze and describe this link between knowledge generation in firms and external factors in the specific context of mobile telecommunications, more specifically the development of the GSM system.

- IPRs are obviously not the only factor having an impact on strategic alliances

- In today''s turbulent business environment innovation comes about by the interplay of two distinct but related factors: endogenous R&D efforts and (quasi) external acquisition of technology and know-how

- The ownership of essential IPRs

. The position of a firm in the overall structure of the network of strategic technology alliances

. Technology assets and firm success in high-tech markets where standards are important

- Table 1, these five players hold approximately 85% of the market or more

  → Ericsson, Nokia, Siemens, Motorola, Alcatel

  → Motorola in switching, Siemens in base station and mobile terminals,

  Alcatel in terminals (Market share of 10%)

- The ownership of essential IPRs (as a result both of technological competencies of firms, and strategic management decisions), and the position of the firm in the network of strategic alliances.

Table 1

Supplier	Market share switching (%)	Market share base stations (%)	Market share mobile terminals, world-wide (%)	Rank on total GSM market
Ericsson	48	37	25	1
Nokia	14	22	24	2
Siemens	21	2	9	3
Motorola	1	13	20	4
Alcatel	10	10	6	5
Lucent	2	4		6
Matra	2	3		7
Italtel	0	5		8
Nortel	1	0	3	9
Philips	0	2		10
Orbitel	0	2		11
Other	1	0	13	–

Source: Bekkers and Liotard, 1999, pp. 123–124. Ranking is based on the average of all three subsystems market share, assuming that all subsystems are roughly equally important in the total sales GSM suppliers. Recent market shares are not very different from those in 1996, although for mobile terminals Nokia seems to have won a higher share at the cost of Ericsson.

□ The role of IPRs in telecommunications and GSM (1)

- IPRs for major inventions of prime importance (Brooks, 1975)
  . The American Bell Telephone Company (later AT&T) owed its dominant market position
  . Pupin Coil & Strowger switch turned he success of firms

- the early phase of the life cycle of the industry the role of IPRs in the telecommunications sector waned with the emergence of the state-owned monopolist networks operators
  → PTT의 Post Telegraphy and Telephony operators

- Manufacturers was fully paid for by the operator, resulting in questions with regard to the ownership of the resulting IPRs

- This world-wide liberalization strongly increased the importance of IPRs in the telecommunication sector. At the same time, the importance of technical standards for telecommunication system was growing.
  → There were several reasons behind this development
  .The increasing demand for international communications required common standards to interconnect such networks
  .The introduction of data communications between computer systems
  . Digital systems called for economies of scale

- IPRs and standards obviously have a troublesome relation (Bekkers and Liotard, 1999).
  → The main aim of IPRs, on the contrary is to restrict diffusion

□ The role of IPRs in telecommunications and GSM (2)

- Still, although IPRs and standards

  An IPR is non-essential to the standard when other implementations are available, while the knowledge described in an IPR is essential to the standard if it is the only way of ''doing things'' while adhering to the standard. Obviously, an essential IPR for a certain standard has a great strategic value.

  The standard has been established, an essential IPR has great value in negotiations about the exchange of technology, or in licensing negotiations.

- There are several reasons why telecommunications standards are increasingly covered by IPRs

  . The high R&D investments and patent intensity in this sector

  . The development into a truly open, world-wide market for standardized equipment, which increases the need to protect the results of research efforts

  . Telecommunications standards are most often compatibility standards, requiring that the interfaces are described in a very detailed and conscientious way

  . The fact that most standards are based on proposals that are developed by manufacturers

- GSM, compared to its predecessors, would have to be an improvement in a number of ways

  . The new standard had to profit from real economies of scale

  . It would have to make operators less dependent on their suppliers by means of increased competition, and by defining not only the air-interface but also other, intra-network interfaces.

□ The role of IPRs in telecommunications and GSM (3)

- GSM Memorandum of Understanding (MoU) Impact

. Committing themselves to procure GSM networks. As a result, the reluctance of manufacturers changed into enthusiasm when the potential market size of this standard became apparent

- IPRs problem peaked when Motorola refused to grant non-discriminatory licenses for its sizeable portfolio of essential patents that turned out to be essential for GSM

. The behavior of Motorola strongly influenced the supply market structure in the sector, but could not obstruct the success of the standard

. European regulations resulted in two or more GSM operators in each EC member state, and GSM subscribers grew tremendously in all countries, especially from 1994 onwards

. GSM, and this forced Motorola to lift the regional restrictions in its licenses. With the use of IPRs, Motorola succeeded in having an interesting revenue stream even though it could not offer switching subsystems and even though it knew that its market prospects were restricted

- GSM handset licenses is very high, and this was recently confirmed by the actor director of the ETNO,11 who revealed that royalty fees make up to 29% of the costs of GSM handset.12 Such prices make competing very difficult for those companies that are not participating in the cross-license fees

□ Essential patents in GSM (1)

- Above, we have stressed the importance of essential IPRs in telecommunication standards
  → The predominant form of IPRs in telecommunication
  . ETSI list contains 380 entries for GSM
  . European patents or PCT applications filed either at European patent office (EPO) or WIPO). Some companies report only patents in Europe or the US
  . one invention may in fact appear as several patents, because of the filing of applications in multiple countries

- ETSI 3Type of patents
  → European patents, US patents and International patents
  → GSM IPR to ETSI Control (data base Service)

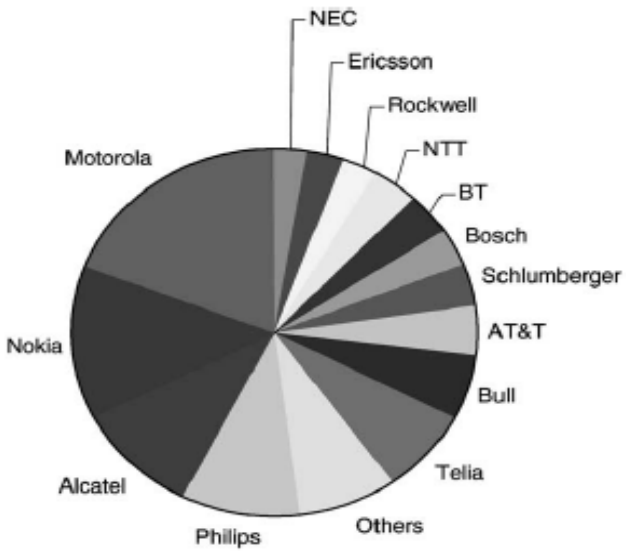

Fig. 1. Shares of firms in essential IPRs in GSM.

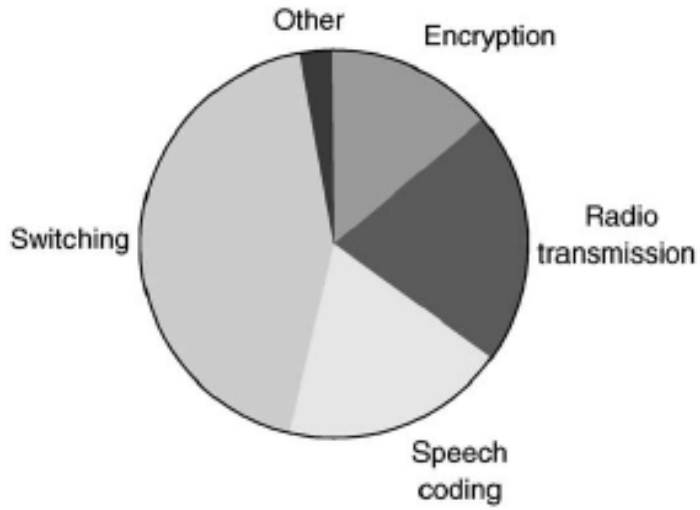

Fig. 2. Shares of technical fields in essential IPRs in GSM.

□ Essential patents in GSM (2)

- International Patent (IPS), 5Parts grouped the data technical classes
  → encryption, radio transmission, speech coding, switching, and other

- GSM In light of the history
  . The choice for the basic technology was made, i.e. February 1987
    → In this period, different technologies and proposals were being developed
  . During this time span, the exact implementation of the standard was decided upon, and product development took place in parallel
  . New services and other additions to the standard were developed and standardized

- Gives the shares of these technical classes in the total amount of patents

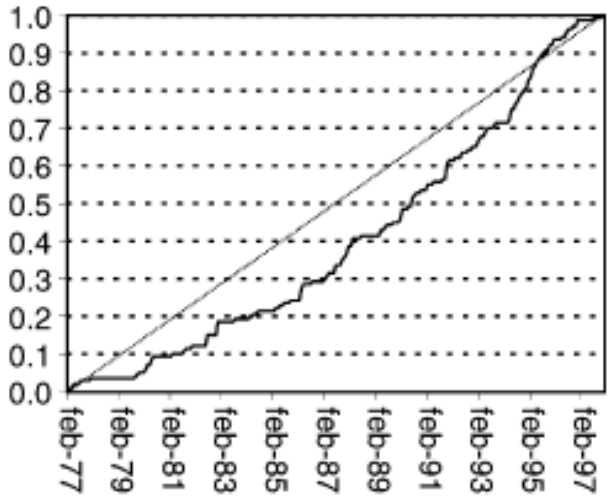

Fig. 3. Cumulative share of essential patents in GSM as a function of time.

1987~1997 누적특허 건수

Almost the complete period, the line is below the 45 degrees line

□ Essential patents in GSM (3)

- A similar indicator for the separate technical fields, with the exception of the small ''other'' field

. First, it is clear that encryption was the field that developed first. In fact, the inventions in this field were originally developed for a completely different field of application, i.e. bankcards, and were subsequently applied to GSM, where they were used for the Subscriber Identification Module (SIM-card'').

. Third, developments in the other three fields are more or less parallel. The lines of these three fields are remarkably similar, and are never very wide apart. This may indeed indicate that the three major fields of the GSM technology developed as an intertwingled set of technology

. patents were applied for that relate to these services.

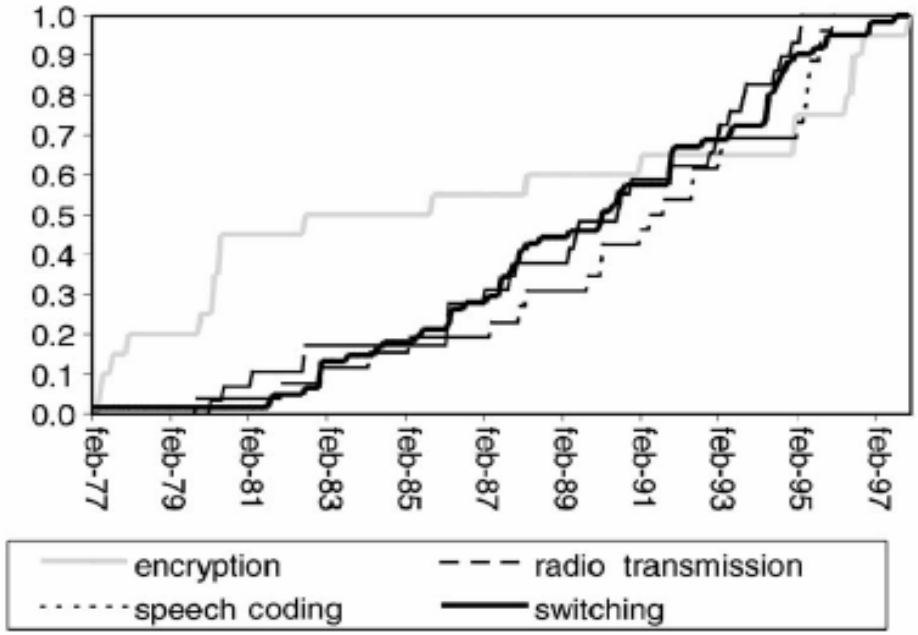

Fig. 4. Cumulative share of essential IPRs in GSM as a function of time, broken down by technical fields.

□ Essential patents in GSM (4)

- GSM에 중요한 IPR의 누적 수가 기업간에 기술혁신을 시사

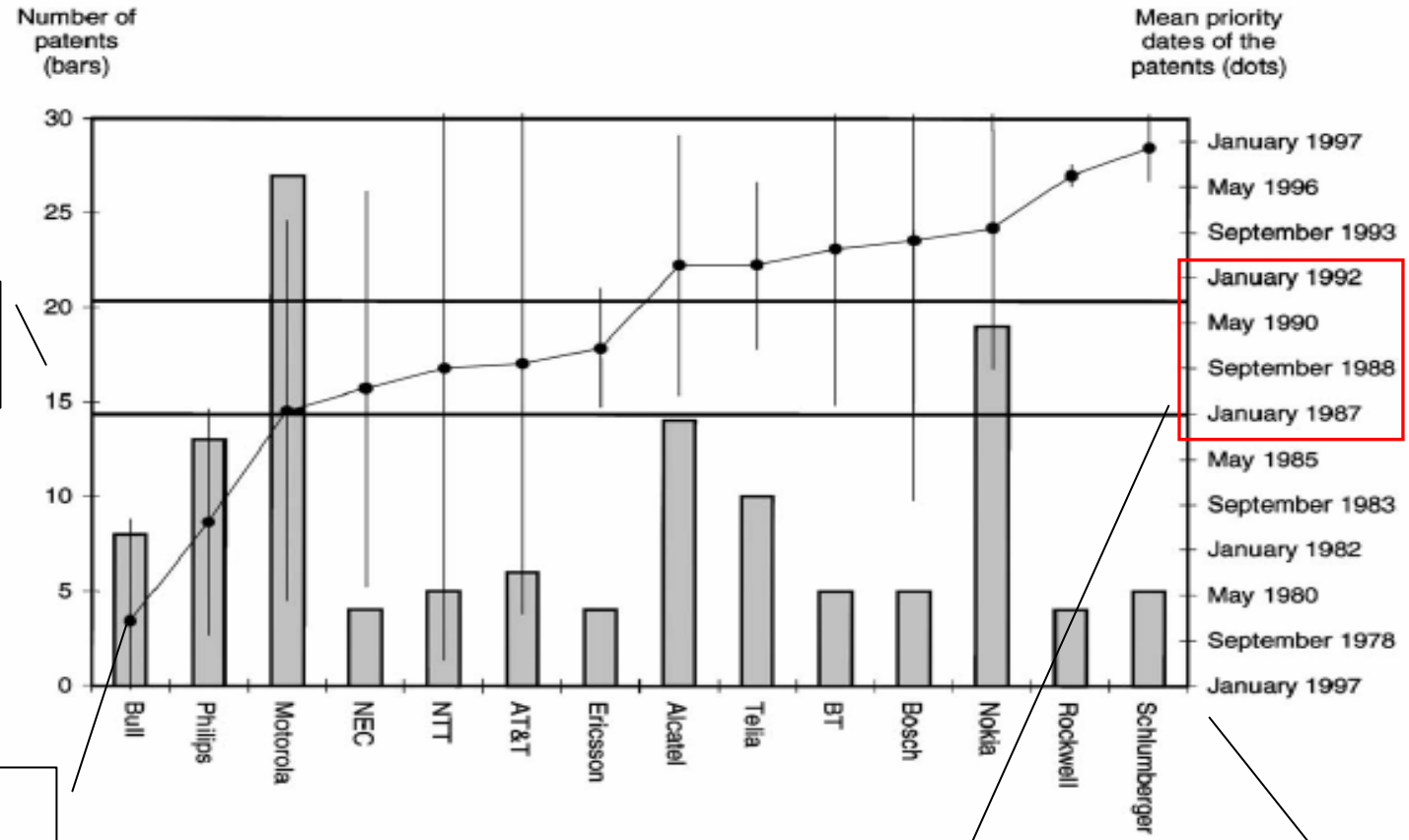

Fig. 5. Timing of firms with regard to essential IPRs in GSM.

특허번호

평균 우선일

표준시대

변동

□ Essential patents in GSM (5)

- Motorola had the advantage that it already had some of its work from the pre-standard period laid down in essential GSM patents

. products came to the market showed that this firm had two aims with its intensive patenting activities.

. its licenses enabled it to prevent GSM from being adopted in other world regions in which it had different interests.

. it could set specific license conditions, such as cross-licensing, enabling access to other firms'' technology and dictating the structure of the supply market

- Motorola was able to build up a strong position in essential patents, with other firms lagging behind considerably.

- Nokia & Alcatel strongly increased inventive activities, patenting thereof→ large portfolio of essential patents in GSM

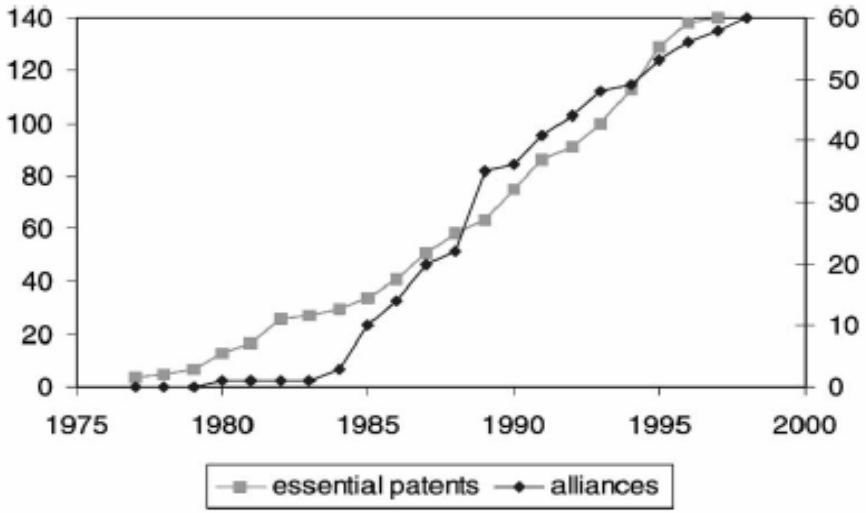

Fig. 6. The cumulative number of strategic alliances and essential patents in GSM.

□ Essential patents in GSM (6)

- GSM IPR 수와 시장 우세가 가설 일치

Table 2
Network centrality scores, 26 firms with highest degree centrality

Company	Mother firm	Original network			Network with mergers		
		C_D	C_B	C_C	C_D	C_B	C_C
Philips		23.4	25.5	42.7	23.7	18.9	42.7
Ericsson		21.3	51.6	47.5	23.7	35.0	48.7
Nokia		21.3	18.0	39.2	26.3	19.8	42.7
Motorola		21.3	25.5	43.5	26.3	29.0	48.7
BellSouth		17.0	22.8	29.9	21.1	13.9	34.5
Bosch		14.9	13.2	33.6	13.2	5.6	33.3
Siemens		14.9	5.5	38.8	15.8	4.1	38.4
Matra		14.9	10.3	38.2	15.8	6.2	39.2
Racal		12.8	16.5	36.7	15.8	17.0	38.4
Alcatel		12.8	7.1	35.9	13.2	7.0	38.4
American Personal Communications		12.8	0.0	23.7	15.8	0.0	28.8
American portable telecom		12.8	0.0	23.7	15.8	0.0	28.8
Intercel		12.8	0.0	23.7	15.8	0.0	28.8
Omnipoint		12.8	0.0	23.7	15.8	0.0	28.8
Pacific Bell	Pacific Telesis	12.8	0.0	23.7			
Western wireless corporation		12.8	0.0	23.7	21.1	13.9	34.5
AEG		8.5	1.5	33.1	7.9	0.1	33.0
Intelsa	Ericsson	8.5	28.9	37.9			
Cable and wireless		8.5	12.2	32.0	10.5	19.8	40.0
AT&T		6.4	0.0	31.8	7.9	0.0	31.1
Compañia Telefónica Naçional de Espagna		6.4	2.0	33.8	7.9	3.0	38.8
SEL	Alactel	6.4	0.0	31.1			
ANT Nachrichtentechnik	Bosch	6.4	0.2	31.5			
Orbitel	Ericsson	6.4	0.0	35.1			
Mannesman		6.4	4.3	24.7	7.9	5.3	31.4
Psion		6.4	0.0	36.7	2.6	0.0	33.0

□ Strategic technology agreements in GSM

-The data on strategic alliances used in this paper are based on the MERIT-CATI database
→ the 60 strategic technology alliances that are related to GSM technology

- The expression interfirm co-operation is used to refer to those co-operative agreements between partners that are not connected through (majority) ownership at the outset of the period under study

- Thus, strategic alliances seem to have become an essential vehicle for technology transfer in the GSM market

- Analyze the role of individual firms in the GSM alliance network
. the relationship between centrality and power within networks (Freeman, 1979)
→ Degree centrality (CD), betweenness centrality (CB) and closeness centrality (CC)

- Motorola is the first to catch up, i.e. during the period immediately after the acceptance of the basic GSM standard (1988--1992)
→The movements of these two firms are rather erratic, and jumps or falls20 are mostly related to a single year, i.e. one or two isolated alliances.

- The catch up of Motorola in terms of networking position was thus largely based on the aggressive patenting strategy the company had followed during the early phase of development of the GSM standard

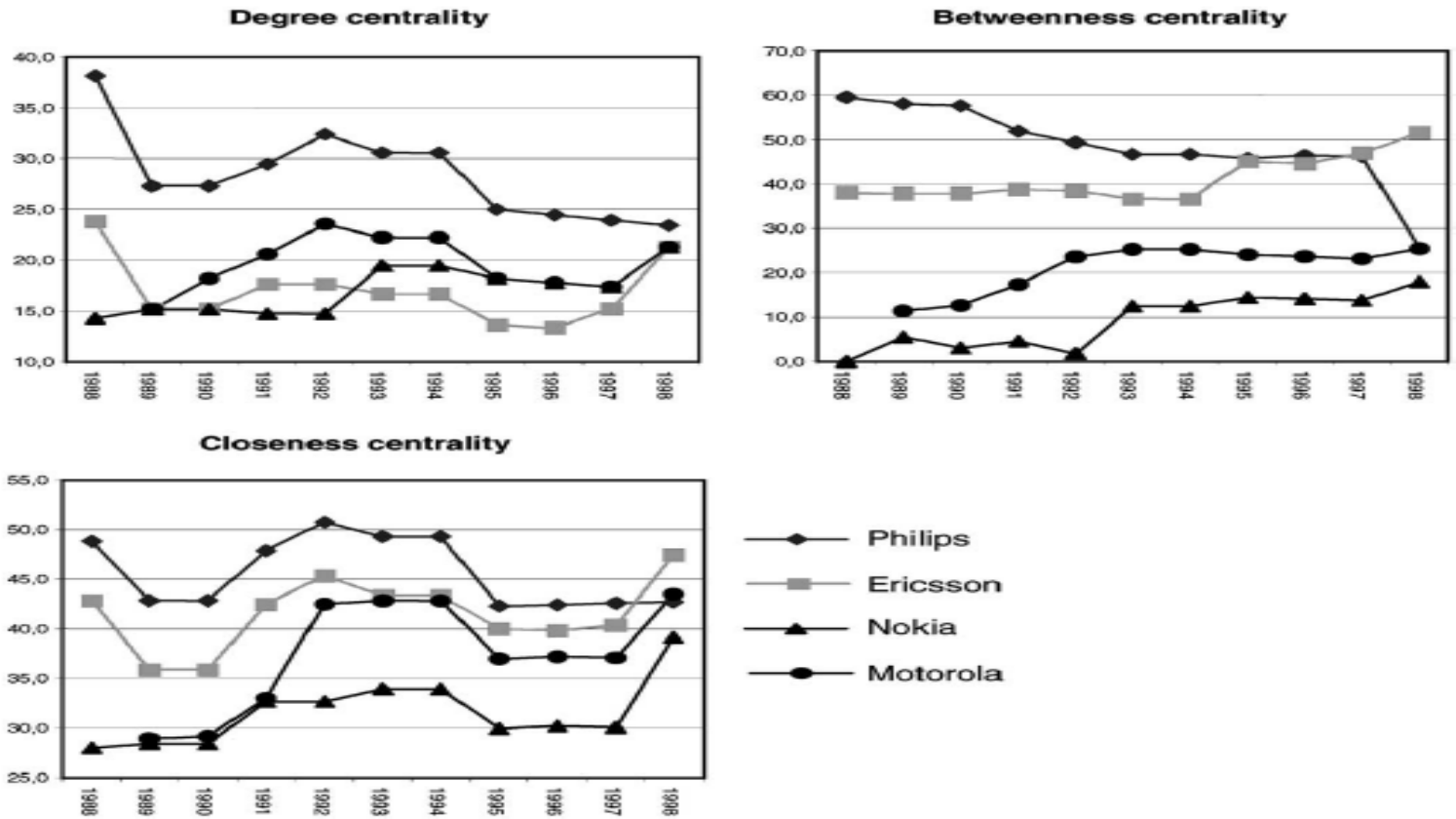

Fig. 7. The evolution of network centrality for the four most central firms in the network.

□ Conclusions and discussion

- The GSM case provides an interesting example of how (essential) IPRs ownership and alliance networks influence each other, and how both of them affect market structure and market share

- Ericsson, Nokia, Siemens, Motorola and Alcatel. Together, these five firms control more than 85% of the European GSM market

- Motorola and Nokia) are characterized by both a strong position with regard to the ownership of essential IPRs and a central position in the network of strategic technology agreements in mobile communications

- We identified three periods in the history of GSM.

- By using the negotiation power that came with its patent portfolio, Motorola could dictate its licensing conditions to all firms

- Motorola took the position of firms in the alliance network into account when selecting its cross-licensing partners (Ericsson)

- Many firms have intensified their patenting activities, hoping to obtain essential IPR for future standards or additions to existing standards