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# Public and private investment in the roots of the mobile phone industry in Spain: Indelec, 1984-2003

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**Abstract**

*This article deals with the forge and results of an alliance between the monopoly operator of the telephone service, the multinational capital and an autonomous administration determined to recover industrial fabric thanks to introducing advanced technology of telecommunications in a territory (Basque Country) punished by the depression during and after the industrial reconversion of the first years of the decade of 1980. It tries to shed light through a case study on possible differential elements with regard to the strategy that multinationals followed on other occasions. The methodology used comprises the drawing of the contextual framework of the central facts and the story of the conception, birth and trajectory of the company indicated. The work follows the trail of sectoral studies of an aggregate nature, published a decade ago, to which the perspective of business history adds. In a second axis, it adopts the comparative perspective to contrast different situations and circumstances studied. Other fundamental aspects also emerge, such as the link between regulatory activity and industrial policies at different levels of development and execution.*

**Keywords:** INDELEC, Mobile telephony, Radiotelephone, Companies, Industrial policy, Alliances

**JEL codes:** NO0, L12, L20, L50

## Introduction

The article traces the origins and first development of mobile telephony in Spain, from the first 'car phones' by Philips or Ericsson and the first pocket phones - the Poctel 2000 - to the era of consolidation and global expansion, momentarily cut short by the bursting of the dot.com bubble, whose technological drivers were microprocessors, especially the Intel 8086, and the high-speed data exchange system. More specifically, the study focuses its attention on the forging and results of an alliance between the monopoly telephone service operator (Telefónica), multinational capital and a regional administration determined to recover the industrial fabric thanks to the introduction of advanced telecommunications technology in the Basque Country (BaCo). This region was a territory punished by depression during and after the industrial reconversion of the early 1980s. Later on, it became a regional peer group of medium technology manufacturer and service providers, included among the industrial production zones of the OECD[1] .

The methodology used in the study consists of drawing up the contextual framework of the central facts and relating them, i.e. the conception, birth and history of the company INDELEC. The second axis passes through the comparative perspective to enrich the various situations and circumstances studied.

In this article, two interrelated hypotheses are contrasted. The first one tries to prove if the policies of attraction of the advanced technology developed by the multinationals of the sector contribute to overcoming chronic delays. The second is to determine whether there were differential elements concerning the strategy followed by the multinationals on other occasions.

The article follows the trail of sectoral studies of an aggregate nature, published a decade ago[2]. It adds to them the business history perspective, which capturing the "texture" of the base material of the sector, that is to say of the company, through the analysis of the trajectory of INDELEC, a radiophone company. Other fundamental aspects also emerge, such as the linkage of regulatory activity and industrial policies at different levels of elaboration and execution.

It is somewhat disconcerting to note that Spain sometimes has difficulty in looking at statistics. Bringing to light practically out of the blue a case which is widely cited but little studied has been possible thanks to the use of primary business sources and various public administrations involved, as well as oral testimonies from people with varying degrees of responsibility in the episodes described. Among these, those of INDELEC and Telefónica, one of the players in the story, outstand for their exceptionality, since, within the lack of general information, they provide valuable details about the development of the company that serves as the case study. Those of the Basque Parliament also stand out, as they provide details about the political environment in which INDELEC's creation and evolution were taking place[3]. The study tackles issues of importance in the company's history in its productive, investment or financial aspects but focuses on the role played by the country's institutions, both state and regional, in the shareholding structure.

The work is structured in three large sections, framed by an explanatory introduction and some conclusions. The central body begins by drawing up a general picture of the expansion of wireless communications. Then it goes on to analyse the overlapping of industrial policies, regional development and the strategy of multinationals, the combination of initiatives around a new joint venture -INDELEC- located in the BaCo and the replacement of the technological leaders in this venture.

Some preliminary questions need to be clarified. The first alludes to a terminological definition and refers to information and communication technologies (ICTs), a sector which includes radio, the object of research in this article. ICTs correspond to the condition of General Purpose Technology, which has been described by evolutionary economists, headed by Paul David, as affecting the entire economic system[4].

The second point refers to the strategic nature of the sector, which calls for regulation. This function corresponds in the first place to the International Telecommunications Union, which defines the standards in each generation of mobile telephony. In turn, the supranational organisations - the EU in this case - determine the guidelines in this respect and leave it to the governments of the national states to define the precise systems[5]. It should be underlined that the study approaches the origins of mobile telephony in Spain from the perspective of the equipment industry and not from that of the service or technology, which is the main focus of the literature (Pérez Sanjuán, coord., 2006; Vergara and Huidobro, 2016, pp. 142-145; Calzada and Estruch, 2011, pp. 39-69; Calvo, 2019, pp. 3-30). This aspect is the first differential element of the article. The second one concerns the mixed nature of the protagonist company as it is a joint investment between the non-state public sector - an autonomous government - and the company, represented by two multinationals and a semi-public telephone operator, about to lose its monopoly privilege and start a phase of open competition.

The third point concerns the territorial framework and the definition of its characteristics related to the subject matter under discussion. As far as the level of communications and information is concerned, in 1990, the BaCo occupied a very prominent position in the ranking of the level of ICTs in Spain. In fact, it was in second place, behind Madrid and ahead of Catalonia[6]. ICTs, an emerging sector in the BaCo, were at the head of the booming telecommunications cluster, which had a turnover of between 100,000-150,000 million pesetas and employed 6,000 people[7].

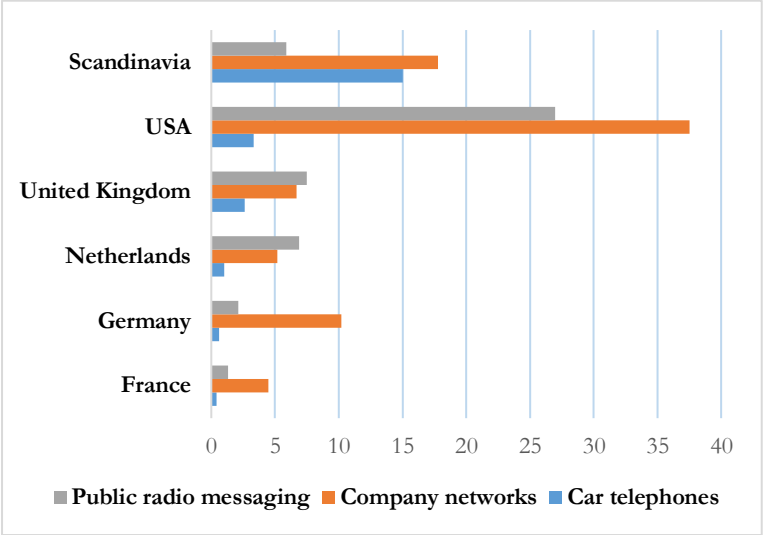
The last issue concerns the small size of the business under analysis, an aspect which do not detract from its representativeness given the small number of companies of these characteristics in Spain[8].

## The Expansion of Wireless Communication Systems

As the International Telecommunication Union points out, at the end of the 20th century, we have witnessed the extraordinary expansion of wireless communications[9]. This system allowed multimodal communication from one place to another provided the appropriate infrastructure was in place and has spread rapidly[10]. Places far from civilization or geography hostile to the deployment of copper lines have been incorporated into the communication. The same has occurred with traditionally marginalized segments of the population, without completely breaking down the barriers of poverty and gender inequality, as recognised by The Mobile Gender Gap Report of 2018.

Implementation of this technology by countries followed different paths depending on the level of development, available technologies and policies adopted. Nations resolved with differentiated formulas the necessary availability of networks and user equipment. To limit ourselves to one case of a country that will be a frequent reference in this study, France, without waiting for the development of digital radiotelephony, decided to meet the needs of its backward market with a new network of analogue technology. The installation and operation of this network were entrusted to the Compagnie Générale des Eaux, which relied on investments of its funds and the technology of the Finnish Nokia and the French Alcatel. Compared with two other competitors - Société Lyonnaise des Eaux and the Bouygues group - the successful candidate was considered being best equipped to provide maximum and rapid coverage of the metropolitan territory while ensuring the best future capacity of French industry in the sector[11].

More specifically, the disparity in the spread of mobile radiocommunications by the major industrialised countries is satisfactorily reflected in Graph 1 and Annexe 1. The former clearly shows the preponderance of the United States and the resulting backwardness of Europe to the leading country, as well as the differences within Europe, where the Nordic countries were in the strongest position[12]. Certainly, not all services had similar levels of penetration by country, as shown in Figure 1, and there will be an opportunity to examine this later for the mensafonic service[13].




**Graph 1. Mobile radio communications in a group of industrialized countries around 1987. Penetration rates/1,000 h.**

**Source: Elaborated by the autor from Ministère des PTT (1987).**

[**Note:** Car phones and company networks: no. of mobiles/1,000 h.; public radio messaging: no. of receivers/1,000 h]

In its evolution, the use of the radiotelephone spread in service companies and in some public services such as taxis, which needed to attend punctually to the requirements of the clientele[14]. To mention one of the regions, in Catalonia, closed group radiotelephony was used as an internal service in economic sectors or official bodies with a significant need to communicate with personnel scattered throughout the territory[15].

It should be noted at this point that radiotelephony is not reduced to public mobile communications and that, even if it is limited exclusively to the provision of telecommunications services based on voice transmission, the networks intended to provide such services may be public or private. This distinction is crucial in terms of the technology needed, the investment required and the regulation involved, among others.

Mobile radiotelephony gained significant momentum with the development of techniques that significantly improved the use of the always scarce radio spectrum, including new digital modulations, cellularization, encryption and channel access. On the supply side, investments by network providers in mobile systems such as TMA or Telepoint and the decision by the European Community to develop the pan-European digital mobile system GSM and a pan-European radio messaging system ERMES (European Radio Message System) together with an excellent response on the demand side were the decisive factors for the growth of mobile telephony[16]. Private mobile radiotelephony tended to a new concept - communications or personal telephony - through two lines of development with trunking systems for large extensions and short ranges with digital wireless phones, digital switchboards with wireless extensions and local area networks via radio.

The market was dominated by a small group of manufacturers, formed by four European companies - Ericsson (Sweden), Phillips (Netherlands), Nokia (Finland) and Siemens (Germany) -, one American - Motorola -, one Canadian - Novatel - and two Japanese - Mitsubishi and NEC. Most of these manufacturers of network elements and base stations were also competitors on the terminal market. In Spain, the suppliers of this equipment were Intelsa (Ericsson), Indelec (Phillips) and Motorola.

The industry, on the other hand, produced user terminals specialized in specific services such as switchboards and interconnection systems, telephones, fax, TMA terminals and videotex[17]. An absolute rarity in the Spanish mobile phone scene was Vitelcom Mobile Technology SA, (2001), located in the Andalusia Technology Park. It absorbed know-how from INDELEC -qualified work- and produced five million terminals a year. Its total dependence on Telefónica meant the company's take-off and its demise, as the drop-in demand from the operator dealt it a mortal blow[18].

## Industrial policy, regional development and multinational companies

For years, the European Union regarded telecommunications as an excluded sector, subject only to rules on general matters. By 1984, the Commission of the European Communities had begun to develop the Community's telecommunications policy and from then on carried out extensive regulatory work in the sector, with the ultimate aim of achieving a unified market. In that year it set up the Information Technology and Telecommunications Task Force and developed the essential strategic approaches of its policy: creation of a Community market; reduction of uncertainties for operators and manufacturers; improvement of the state of the art and Community cohesion by promoting the modernization of networks and advanced services in the most disadvantaged regions. These approaches, which took the form of concrete measures, were subsequently taken up in the Green Paper on the establishment of the common telecommunications market of June 1987. The players in the sector - Community and Member State institutions, operators, manufacturers and users' associations - drew up a broad outline. These included the unrestricted opening up of the terminal equipment market, subject to approval procedures; the maintenance of special rights for telecommunications administrations concerning to the provision and operation of network infrastructure; the substantial opening up of telecommunications services to competition, with the safeguarding of public service objectives through the maintenance of special or exclusive rights for the provision of a certain number of basic services; the clear definition of general requirements for the use of the network, imposed by the telecommunications administrations; the definition of open network provision (ONP); the separation of regulatory and operational activities of the Community administrations; the monitoring of the regulatory and operational activities of the administrations and public and private operators and, finally, the implementation of a common commercial policy for telecommunications. The broad lines were embodied in a set of rules, which advocated the development of the common market in telecommunications services and equipment. It also established a category of reserved services - voice telephony services - which, by generating the bulk

of revenues (over 85 per cent of the total), guaranteed the financial viability of operators. Finally, it established the separation between the operation of services and regulatory activities. For this paper, the central guideline abolished "exclusive or special rights for the provision of telecommunications services" for all non-voice telephony services, including mobile radio and radio messaging[19].

Similarly, at the territorial level, it is worth defining the regulatory and institutional framework within which INDELEC was created, while stressing once again that the study focuses on the equipment industry and not on service.

The Basque Government played a role as an intermediary in the telecommunications sector through political pressure aimed doubly at the direct creation of enterprises and the promotion of comparative advantages for the Autonomous Community. The autonomous government's aid account for all the initiatives amounted to 158 million euros (26,400 million pesetas) in 1996. Throughout the 1980s and in the first years of the following decade, the Basque Executive took various initiatives to computerize the regional administration, extending the networks implemented to other areas of the region and creating a regional telecommunications operator. In 1982, it created the Basque Government's Information Society (EJIE), which it entrusted with the implementation of computer technology in the regional administration, the interconnection of the region's universities and the promotion of a microwave network for data transmission. This was followed by the Government's Official Communications Network, responsible for providing the transport and broadcasting services for the programs of the radio and television stations.

The "Europe 93 Plan", which had the financial support of the European Union, put the finishing touches to this. It aimed to develop a public fibre optic infrastructure and the public radio and television service as well as office and telematic services of the Basque administration. From the beginning of the following decade (1993), the Basque Government's Telecommunications Society, EUSKALNET, became the instrumental agent of the Government's actions in the field of telecommunications and managed to gain a substantial share - by mid-1999 more than a quarter - of the telephony market in the region. Different institutions were designed to act in the sector with a clear distinction between the public sphere - Basque administration services and relations with citizens - and the private sphere - services in companies and households. The actions to be carried out in the public sphere, included in the concept of "promoting the information society", covered three areas, namely the Basque Telecommunications Centre, the Basque Science and Technology Plan 1997-2000 with its renewal for the period 2001-2004, and EUSKALTEL as a support for new and cheap telecommunications services in the region. Significant for what is being narrated here, in 1997 Ericsson supplied EUSKALTEL with an intelligent network together with a complete package of turnkey services. There was no lack of contacts with the outside world to promote actions to create a telecommunications network in the BaCo[20].

On October 1995, the Basque Government's Department of Industry carried out a "Diagnosis of Competitive Positioning and Identification and Prioritization of Options" on all the telecommunications products and services companies in the region. With this initiative, it aimed to make progress in the creation of a "Basque Telecommunications Nucleus", the implementation of which it ensured almost a year later, through two bodies: the Association of Basque Telecommunications Industries and the Advisory Council of the Nucleus. For its part, the second area in which it developed competences was the Science and Technology Plan 1997-2000[21]. The Basque Government promoted a single demarcation of cable in its territory, a possibility included in the Cable Telecommunications Act, and exploited the possibilities of participating in national and European Union institutions that discussed issues in the telecommunications sector. The regional government saw liberalization as an open window to greater decentralized prerogatives and sought to become involved as a promoter and consumer of new services (Information Systems and Telecommunications Plan 1997-2000), the promotion of the information society and the convergence of interests in the sector.

As the European Commission points out, the BaCo has traditionally been a vigorously industrial-based economy that has exerted a certain attraction on foreign capital, which brings us to the central question of the story[22]. In other words, the key company on which we are going to focus attention takes on a significant but not predominant role in business activity. It is the result of the confluence between the industrial policy promoted by the regional government, the driving role of

the key telecommunications company in Spain - the Compañía Telefónica Nacional de España, CTNE, or more simply Telefónica- and the expansion strategy of the multinationals.

In the BaCo, the industrial policy of incentives and promotion of the increase in business competitiveness and productivity took the form of the creation of institutional instruments, such as the Society for Industrial Promotion and Reconversion (SPRI) and the Technology Parks, with pioneering clustering processes in the most decisive sectors of the Basque economy since the beginning of the 90s, including ICTs.

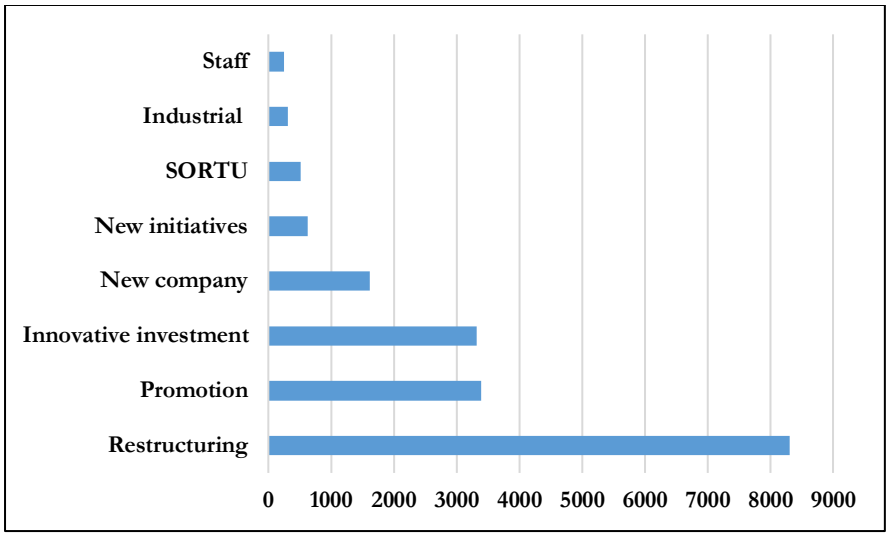
It is clear that the leading role is played by the regional administration, but we must not forget the regulatory and financial intervention of the central government, starting with the industrial reconversion law of 1984 and continuing with the National Electronic and IT Plans, together with the programmes to promote R&D[23].

The Society for the Promotion and Industrial Reconversion, S.A. (Sociedad para la Promoción y Reconversión Industrial, S.A, or SPRI) was incorporated on 21 September 1981 by application of Law 5/1981, of 10 June, as a complementary instrument for the promotion and reconversion of Basque industry and, as a priority, for the defence and creation of jobs[24]. The Law empowered this company to participate in the capital of companies of particular relevance, upon authorisation by the Basque Government and under the conditions to be stipulated in each case. At the end of 1993, SPRI was involved in half a hundred companies, with a majority shareholding in the bulk of them, i.e. 44. Of the majority shareholdings, a third were in debt to financial institutions, while two of the minority shareholdings (INDELEC and Urnieta Lantzen) were in the same situation. Finally, one was financed directly by SPRI - the Zamudio Business Centre[25].

Now, let's take a look at the role played by the SPRI in its various areas of activity[26]. From its creation until 1995, the SPRI granted various lines of loans amounting to PTA 18 340 million. The bulk of these corresponded to conversion loans, granted during the four-years 1981-1984 and aimed at the reorganization and conversion of companies in critical situations. From 1984 to 1986 they were replaced by promotion loans, intended to support the creation of new companies or to undertake projects of technological interest in existing ones.

During the period 1987-1992, innovative investment loans followed, aimed at SMEs mainly in the ICT sector and with investment projects within the ACBC. At the same time, loans for new business initiatives were launched, aimed at newly created companies and individuals who were starting on their business experience for the first time. In 1993 and 1994, two successive lines of new business creation loans were started, both of which were aimed at newly created, high added value, industrial processing SMEs - a workforce of fewer than 250 workers and own resources of less than 750 million pesetas. The difference lies in the fact that they are considered to be industrial development areas within the geographical scope of six SORTU companies distributed throughout the territory. For its part, a single loan granted by SPRI in 1994 to a company in the timber processing sector was classed as a loan to industry. Finally, personal loans (1986 to 1992) were intended for individuals who were involved in a business project in the context of new business initiatives (Graph 2)[27].

Through Saretek Basque Science, Technology and Innovation Network, the BaCo had the most powerful network of scientific and technological infrastructures in Spain and a European reference in several fields. The origins of the Saretek date back to 1986, when the regional Government decided to bring together the five-existing technology centres and support companies in developing and strengthening their competitive capacities. Saretek managed to set up a science and technology system with more than 70 agents, 4,700 researchers and revenues of more than 200 million euros, 65% from the private sector and 35% from the public sector[28].




**Graph 2. Loans granted by the SPRI and their structure, 1981-1995 (million pesetas)**

**Source: Elaborated from Basque Court of Public Accounts (1997), p. 40.**

Basque institutions have endowed themselves with investment support instruments of a different nature. The pioneers appeared in the field of venture capital, a category to which the Sociedad Gestión de Capital Riesgo del País Vasco (SGCPV) belonged, created by the SPRI in 1985 and which managed more than 26,300 million pesetas between 1986 and the end of 2001. The SGCRPV was followed by investment subsidies, later supplemented by tax incentives. The first formula took the form of the Investment Support Programme (PAI, in Spanish) in 1988, which brought together all the existing programmes and gave priority to investments with higher technological content, to SMEs and sectors or activities of preferential interest. Three years later, large investments began to be promoted and, therefore, with greater potential to influence the Basque economy overall. The Strategic Investment Office and the GARAPEN programme, supported by the Basque Capital Development Society (SOCADE) in the field of risk capital, were the result of this orientation. A series of resolutions from the Basque Parliament opened the way for new industrial policy initiatives[29]. As a result, the GARAPEN programme was replaced in 1996 by the so-called EKIMEN programme, which has the same function of attracting large investors, mainly foreign ones[30].

The Basque Government lobbied for the foreign promotion of companies in the Autonomous Community to surround itself with managers of public companies and representatives of private companies. This was the background to a meeting (March 1994) with around a hundred French businessmen organised by the National Council of the French Tourist Board and various sectoral exchange meetings on the telecommunications, energy, agri-food, aeronautics, automobile and finance industries. The aim was to strengthen the presence on the French market, the destination of a fifth of Basque exports. On this occasion, INDELEC was part of the business delegation, together with representatives of forty-three companies and entities, including Gamesa, BBVA, Iberdrola, Mondragón Corporación Cooperativa and the Bilbao Stock Exchange[31].

As regards to the other major players in this story, the location strategies of multinationals are driven by very precise and changing global market conditions. The policies of attraction promoted in their different facets by the national states and regions did not guarantee the permanence of these multinationals in the long term, always in search of optimum conditions for the development of their activity. This was the case with some of them that set up in the BaCo and have been the source of new activities, such as the French glass giant Saint-Gobain (Amorebieta) and the chemical company Cabot (Zierbena, with 83 workers)[32].

Of course, this dynamic did not only affect the multinationals but extended to non-leading companies seeking to set up on Basque soil. One of them, moreover, illustrates the complex process involved in direct investment with the approval and aid of the autonomous government. We are talking about Grotjhon Precise International, S. A. (GPCISA), a project approved by the Office of Strategic Investments in mid-December 1994, subject to a positive report from the international department of the SPRI and the department of Industry and Energy of the autonomous government. The Governing Council of 16 May 1995 approved the subsidies for investment and job creation

resulting from the project, which were still subject to various administrative procedures. The GPCISA project underwent changes in the industrial partner and the financial partners initially envisaged, which obliged the government to request new guarantees. Let's see it in more detail.

Within the framework of the GARAPEN programme, the Basque Government approved the granting of aid totaling 2 billion pesetas to the American companies Grotjhon Precise International and HR Industries, half in cash and a half in land[33]. The aid was intended to commit foreign capital to a joint venture to produce multilayer circuits and to open up a gap of about 1% in the European market. The government set out to analyse the process "on the ground" in order to check on the progress being made and to compare the information provided by the company on its activities in the United States. To this end, it sent to the United States the Director-General of the Basque Capital Development Society (SOCADE)[34], responsible for the economic and financial aspects of the project, and a representative of the international department of SPRI, in charge of the project. The delegates noted that one of the project's financial groups had been changed and that a new, apparently stronger company had taken over the project in its entirety. The delegation requested official confirmation of the new reality and security interests, to which the company responded with a promise to provide them immediately. During their stay, the displaced representatives were informed that, due to internal problems between developers, the company HR Industries had decided to abandon the project. However, the international body of SPRI had made progress in defining a penetration network and establishing preliminary working agreements with an international company at the European level. For their part, the promoters had begun work before the construction of the plant - plans of location, architectural project - and submitted the staff training plan to the Basque Government for analysis and prospecting for aid. This was a training plan which was well over 100 million and with expectations of technical training in the United States. The conclusion of the agreement with the new financial group was followed by a commitment to provide all the guarantees among the investors and lenders, pending the conclusion of the operations and the definitive launch of the project during a visit by the industrial and financial promoters to the BaCo. On the other hand, the government officials contacted several local companies to explain the project as an investment, construction and manufacturing plan to be carried out in the region. GPCISA found an industrial partner and sealed a protocol of intentions with the automotive and electronics industrial group Saturn Electronics & Engineering, Inc. which in October 1996 presented a business plan for a multilayer integrated circuit plant, slightly removed from the initial project. According to the plan, Saturn would acquire all the shares of GPCISA if the project became viable. SPRI assessed the project submitted and the differences from the initial project, and the Saturn Group accepted that an audit would be carried out prior to any action being taken. Specialized personnel from the government visited Saturn and issued a positive report on the situation and the Group's ability to reach a successful conclusion. Shortly before the end of 1996, the government required Saturn to officially ratify its intention to continue the planned project and to submit a detailed plan for it. Having satisfied the above requirements, the Government notified the Saturn Group of its favourable willingness to submit its project to the Office of Strategic Investment. Finally, the Saturn Group declined to proceed with the project due to difficulties probably arising in the very relationship with the financial partners in the United States, without the government having paid any amount[35].

## The conjunction of initiatives: INDELEC

When the company on which this story is based was born, mobile communications had been in existence in Spain for several years. A few lines about its origins are worthwhile, without being exhaustive.

In a scenario of a highly promising future for the development of mobile communications, the CTNE began providing maritime communications services to ships at sea in 1970, followed immediately by services to motorway concessionaires in Catalonia and northern Spain. Likewise, the operator closed various agreements to meet the demand for radiotelephony that was impossible to satisfy with the networks established for general use[36]. The CTNE began to equip itself with mobile teams capable of resolving emergencies situations or ensuring the monitoring of special events in any

corner of Spain. In 1972, it launched the mensafonic or radio paging service, which, after a decade, reached 9,518 subscribers[37].

There seems to be a consensus in attributing the origin of the mobile phone in Spain to the Automatic Vehicle Telephone (TAV), originally called 'automatic vehicle telephone', which began the trial period in 1974 in the areas of Madrid and Barcelona with a capacity for 400 subscribers in each. In December 1975 - and not in 1976, as is generally stated - the new installations in Madrid began to provide service and, the following year, coverage was extended to Girona in Catalonia through equipment with a capacity of twelve radio channels in the Montseny radio station (Barcelona). The TGV was replaced by the first generation (1G) analogue mobile cellular system, called the Automatic Mobile Telephone System (TMA), which took several years to complete. It was launched by the Spanish National Telephone Company (CTNE) during the 1982 World Cup in Spain, and operated on the 450-470 megahertz frequency, based on the Nordic Mobile Telephone's NMT-450 standard and using transportable terminals despite its weight[38]. In 1990, this TMA service extended its offer with the implementation of the system that operated in the 900 megahertz band (TMA-900A). The TMA lines in service increased almost fivefold between 1988 and 1993, from 11,600 in 1988[39].

During the phase under study, mobile telephony went through two new phases of technological change with the development and deployment of the second and third-generation, based on the pan-European digital GSM standard and the universal UMTS standard, respectively. In addition to the technological innovations, both of these were accompanied by a novelty in the operating system due to the introduction of competition[40].

This obligatory reference to the origins and evolution of the mobile phone in Spain serves as a presentation of one of the companies that will have a central role in the creation of the protagonist of this story, as well as the general framework in which its development is inscribed. Under an identical formula to that applied in the case of microelectronics and fibre optics with AT&T and the Japanese company Fujitsu, respectively, Telefónica created a joint venture with technological leaders in the field of transmissions. This acceptance of joint ventures with public capital was similar to that followed by the German multinational Siemens - the creation of Tefosa in Asturias - and diametrically opposed to that adopted years ago by Fujitsu itself when it created Fujitsu España, by case[41]. Even though it repeated the formula of association with multinationals but with lesser strength than those mentioned, the project had the singularity of being based on the non-state public sector - it does not seem insignificant here to point out the impact of the new regional framework - and to seek a demonstration effect. Let us look at the background.

In 1982, the Basque Government awarded the tender to extend the mobile communications network for the police to the Telefónica Hispano Radio Marítima (HRM) branch, in competition with the INI's electronics and computing division. The decision made it a condition that the equipment be manufactured by a company in the Basque Autonomous Territory, namely Radio Industria Bilbaína (RIB), a subsidiary of HRM and also a supplier of equipment for the autonomous police. HRM undertook an industrialisation plan, which required restructuring of the company and investment in fixed assets. On this basis, the government of Vitoria sought to collaborate with CTNE in a genuine industrial project to take over RIB, under the protection of the promising institutional market of the Basque Autonomous Community - some 6,000 million pesetas - and the strong incentives it offered for new industrial initiatives[42].

We shall now turn our attention to the procedures for implementation. In its long-awaited four-year plan, the CTNE had identified the problem of mobile phones in a vacuum in industrial planning and with a large potential market. All the conditions were in place to embark on a common adventure with the Basque authorities, which promised public subsidies and a market for the Telefónica group's products. The monopoly telecommunications operator was open to the participation of a multinational as a technological partner and an instrument for penetrating the foreign market under a general collaboration agreement or under product-specific agreements, with management responsibilities in the former case[43].

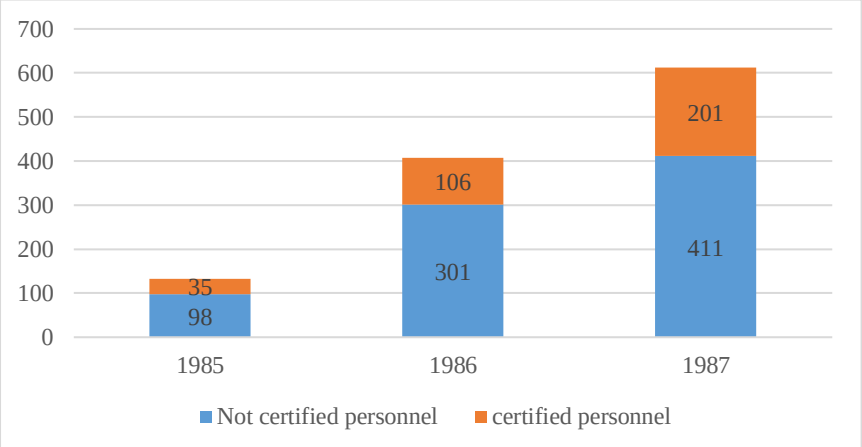
Let's move on to the plans and participants. The company to be created was expected to absorb RIB and have everything from an R&D centre to a commercial, engineering and technical assistance network. In its prospects, it could capture 30-40 % of the Spanish mobile market and export 30 % of production. The initial capital would amount to PTA 300 million, half of which would

be provided by CTNE and the other half by the Basque companies Sociedad de Promoción y Reconversión Industrial (SPRI) and Desarrollo de Nuevas Actividades (DENAC), a subsidiary of the steel entreprise Aceriales[44].

In a scenario of incorporation of a multinational partner, the CTNE would give him 20% and the other partners 5%, while if this did not take place, it would transfer the remaining 20% to other private companies. With that first platform already in place, Telefónica saw it as important to break the relationship between RBI and HRM by purchasing RIB. Finally, Telefónica attracted Philips and led the creation of Industria Electrónica de Comunicaciones (INDELEC) to manufacture radiotelephones - the mobile phones of the time - in the technology park of the Biscayan town of Zamudio, the flagship of the regional executive[45]. The final configuration of INDELEC was settled with several steps of technological, labour, commercial and financial nature. These included the entry of Philips as development and technological partner, the agreement to integrate the multinational's mobile radio communications personnel into INDELEC and the transfer of this market and its important customer base to the company. The steps were completed with the drawing up of strategic and investment plans and requests for aid from official bodies, particularly the Nervión's ZUR[46].

The pattern followed obeyed to the integration of private and public capital, a modality that introduced nuances to certain antecedents in the consumer electronics sector[47]. Telefónica, Philips Ibérica S. A. E., DENAC and the Basque Government through SPRI had stakes in INDELEC of 30, 26, 22 and 22 % respectively. Although this action was intended to be a trial run, the promoters planned to repeat the model in every corner of the country where aid, investment or encouragement was needed. For its part, Philips tested here its future strategic alliance programme serving a network of small high-tech firms[48].

INDELEC started with financial, labour and organisational measures. In the middle of 1986, it doubled its paid-in capital with an increase of 300 million pesetas to meet investments in fixed and working capital and the great expectations of expansion. The workforce underwent three types of change: a 132% increase in production staff compared to the previous year, an increase in more qualified staff and staff training in cooperation with the employment promotion funds. In a short period, the weight of qualified staff in the total increased from just over a quarter to almost a third (Chart 3). The company introduced automatic in-circuit testing systems for the bulk of sub-assemblies, as well as computerized testing systems. The former enabled the detection of possible failures in the early stages and the latter increased the efficiency and quality assurance of the production processes. As far as organisational measures are concerned, INDELEC promoted a major department - systems engineering - using computer equipment for network calculation and created the projects department as an instrument for coordinating, directing and managing complex projects (Graph 3)[49].




**Graph 3. Indelec: evolution of the workforce by skill, 1985-1987**

Source: Own elaboration based on INDELEC, 1986, p. 11

From the beginning, Telefónica's demand meant a fundamental basis for the very survival of the company. The operator passed on to INDELEC major orders for automatic mobile phone base stations, equipment not initially included in the technology transfer contract, even before they were manufactured by the company. This expanded the company's presence in the field of mobile cellular telephony with significant future growth.

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The granting of the second mobile phone licence which followed the liberalisation of the market gave Indelec new options because the winning consortium had opted for digital technology, in which this company was well equipped. For its part, the penetration of the internal market was based on a commercial network of small distribution companies, centred on Madrid but extended to other areas. The offices in Madrid and Barcelona and the delegations in Seville and Bilbao were the first to be established. The reorganisation of the technical assistance service in facilities with an increase in the number of people and the provision of instruments and equipment was also early[50].

Barely four years after its foundation, riding on strong demand for mobile communications and a growing presence in this market, INDELEC carried out an expansion of its production capacity. The new factory in the BaCo Technology Park was seeking to better adapt to the technological advances brought about by its Automatic Mobile Phone or the quality of resolution of its radio searches in the radio messaging sector. The company was considering the possibility of collaborating with other technologically advanced companies located nearby or with niche SMEs, an almost unknown aspect[51].

The expansion was matched by innovation, as INDELEC incorporated new CAD-CAE units into its manufacturing process for the computer design of its products and quadrupled the number of automatic component insertion units. In the field of Research and Development, INDELEC developed a double line of action. For the first one, it created a R&D department, from which it promoted important projects, some of them with outstanding international companies[52]. For the second, it exploited the advantages of the cluster by forging collaboration agreements with technical centres in the country in search of talent and new ideas. As a subsidiary of Philips, with a modest R&D department, reduced to about fifteen people, INDELEC depended on the technology of the Cambridge centre in the UK. The developments that took place were rather adaptations of the products to the needs of the customers. With Ericsson, INDELEC became dependent on Kista for R&D, an innovation ecosystem near Stockholm that took off in the 1970s, and on Kumla and Lund for products[53]. At this stage, INDELEC became one of the Group's main technology centres outside Sweden. The R&D centre in Spain had various skills on a worldwide scale as it concentrated not a few financial, technical and human resources - 7% of turnover, 41.6% of a total workforce of 1,200 people; another half a thousand jobs corresponded to an after-sales service centre for the whole of Africa, the Middle East and a large part of Europe, and the remaining 200 to a third accounting-administrative centre, responsible for legal accounting in some 60 countries. Not surprisingly, it cooperated with the continent's most prestigious communications companies in the aforementioned ERMES radio messaging project, as well as in seven other continental projects. Important contributions were the development of an FFSK interface with the on-board computer for urban bus traffic systems or the development of a signal for incorporation into mobile and portable radiotelephones[54].

INDELEC developed its telephone and imposed its own specifications on the market, so that it sold what the company manufactured, as opposed to what happened at the time of Telefónica. The entry of Ericsson meant a substantial change in manufacturing methods. With Philips, the assembly was manual, while with Ericsson, robotization was introduced in the surface assembly, which allowed a huge increase in production volume and productivity[55].

Even though the Basque Government's participation in INDELEC was interposed, it seemed to guarantee a captive demand. However, this was not always the case to the great surprise of some and obviously to the detriment of the company. The supply and installation of a digital

mobile radio network were awarded for an amount of PTA 2 105 million in a public tender and three days before the end of 1990 to Siemens, the supplier which offered the most suitable system in the opinion of the customer. Named the Ainhoa Project, it was divided into two distinct but complementary phases. It consisted of the implementation of an iso-frequential trunking system with multiple access in the first phase and a digital system to overcome the shortcomings of the analogue network in the second. Therefore, the Ainhoa Project had the characteristics of a private mobile telephone system, unlike Telefónica's Automatic Vehicle Telephone (AVT), Nordic Mobile Telephone (NMT) or Total Access Communications System (TACS), all of which are public mobile telephone "cellular" systems[56]. The project was awarded on the basis of eight main criteria, starting with the possibility of a gradual implementation of the equipment, without interrupting the existing services, and continuing with the optimum territorial coverage and expansion capacity without additional frequencies. The system competed with advantages in terms of traffic volume for the available frequencies and provided its full communication capacity throughout the territory, without the need to adapt the frequency allocation. It was also unrivalled in terms of security mechanisms against sabotage, speed of access to the operator, simplicity of operation by the law enforcement officer and delivery times. Various features incorporated into the system facilitated the management of communications.

The Ainhoa Project was part of the services supported by the official communications network of the Basque Government's Department of the Interior. The budgeted cost, already indicated, became a cost of 1,574,480,433 plus 191 million for the extension of channels. The payment started in 1990 and five years later, over the third was pending approval and payment (Phase II). The installation of Phase I of the network began in 1991 and was then extended to the three historic territories of the Autonomous Community. As it was an iso-frequency system, it only required one radio channel (i.e. a pair of frequencies) for the establishment of communication, even if the members of the group were in the coverage area of different repeaters. The number of channels installed was sufficient to satisfy the call traffic generated by all the groups it served. Even so, the system provided for communications in a different band, which required a different concession. In turn, the network incorporated safeguard mechanisms without guaranteeing the total inviolability of the communication. The call set-up time was less than a second and communication was guaranteed under the most unfavorable conditions. Faced with the difficulties encountered in the functioning and operation of the Ainhoa Project and the complaints made by users, the Department of the Interior tried to optimize the operation of the network by adapting the appropriate software, while studying the technologies and systems of securitization existing on the market to improve the protection of the network. In response to the misgivings expressed, the Basque Government pointed out that the system, far from being in an experimental phase, was being used by the ENEL electricity company throughout Italy and that it was known that it had not been rejected by any police force. The maintenance of the Ainhoa system was entrusted to TECOSA, while up to four companies were responsible for providing this service for the other communications systems. As the optimization of the project was contemplated in Phase II, its implementation did not involve any additional cost, although the possibility of a technical rethink, if the General Directorate of Telecommunications did not grant the necessary frequencies, could increase the final cost[57].

## Readjustments, changes in strategy and replacement of technology leaders

INDELEC had relied on obtaining approvals and acceptance certificates for its equipment, a weapon in the hands of nation-states through their specialized agencies (the Directorate General for Technology Policy, on the occasion) to erect non-tariff barriers to the entry of telecommunications equipment. These were administrative procedures necessary to verify that a product or service was working under the specifications included in a technical standard or norm.

INDELEC's catalogue consisted of mobile and portable transmitting and receiving equipment; portable and mobile radiotelephones, VHF-UHF synthesized base station-repeaters, VHF base stations and repeater equipment (Table 1). Its range of equipment recognised by the regulatory authority was far superior in variety to that of other competitors, including the UK's

Technofone LTD, with its plant in Camberley[58]. Towards the end of the 1980s, Asian competition reappeared on the market with the re-establishment of customs duties on several types of telephone, radiotelegraphy and broadcasting receivers originating in China, which enjoyed tariff preferences under Council of Europe Regulation[59].

| Year | Equipment | Brand | Model | Manufacturing |
|---|---|---|---|---|
| 1989 | Mobile transmitting and receiving equipment | Indelec | FM 1000 | Zamudio (Vizcaya) |
| 1990 | Indelec portable radiotelephone | Philips | PR-710 | Zamudio |
| 1990 | VHF/UHF mobile transceiver | Indelec | PRM-80 | Zamudio |
| 1990 | VHF-UHF synthesised base station-repeater | (Indelec) | - | Zamudio |
| 1990 | portable transceiver (TMA-900-A) | Indelec | I-6222 | Zamudio |
| - | UHF mobile radiotelephone | Indelec | PRM80-TMS | Zamudio |
| 1991 | VHF base station | Indelec | FR-5000-A | Zamudio |
| 1991 | repeater equipment | Indelec | I-6222 | Zamudio |
| 1992 | VHF base station/repeater | (Indelec) | FX-902 | Zamudio |
| 1994 | portable UHF radiotelephone | Indelec | IP-149 | Zamudio |

**Source: Elaborated from the Official State Bulletin.**

Technological and market considerations converged to gradually alter the ownership structure of the mobile radio company throughout the 1990s. Philips divested INDELEC entirely by giving 30% of the capital to the Swedish multinational Ericsson and the remaining 10% to the Society for Industrial Promotion and Retraining (SPRI). It thus lost its status as a technology partner to Ericsson, which was experiencing good times in Europe, while SPRI got 40% of the capital and dethroned Telefónica as the main shareholder[60]. In the middle of the decade, the capital structure remained unchanged with the increase in share capital by Ptas. 625 million, an amount earmarked for the plan to invest in industrial assets to produce mobile terminals in Zamudio[61].

INDELEC embarked on a "focus" restructuring, a widespread practice, and concentrated its activity on the development and manufacture of cellular equipment, based on Ericsson's technology transfer. In this process, it divested its cellular terminal distribution department, sold to Lanmóvil, Landata's new business unit, from the IBV Group, and opened an assembly line plant with an initial investment of 700 million pesetas in Zamudio[62]. These actions took their toll on INDELEC, which added to the list of loss-making companies, even though turnover had increased[63]. Telefónica, compelled by the European Union to divest itself of its stake as an operator, sold to Ericsson the 20.7% still held in INDELEC[64]. In mid-1996, the Swedish multinational turned into the absolute owner of the company by acquiring 10% in the hands of the BBK. This was the result of the company's response to the challenge of diversifying the production of switching equipment, based at the Leganes factory, in the outskirts of Madrid, and of building up its industrial capacity in the radio segment to become a complete mobile telephone supplier and compete with Motorola[65].

Under the name of Ericsson Spain, the new company deployed its lines of action in three complementary directions. They consisted of explaining the advantages of mobile telephony, accelerating the arrival in Spain of second-generation mobile telephony according to the GSM (Global System for Mobile Communications) standard and positioning itself as the leader of the standard. Part of the efforts faced an additional difficulty because Telefónica was investing significant sums in the deployment of a TACS (Total Access Coverage System) network and, naturally, was striving to amortize the investment as far as possible before the arrival of GSM[66].

Ericsson bet on INDELEC in its strategy of concentrating the group's mobile phone manufacturing in a single factory of non-advanced technology - analogue mobile terminals - worldwide under the TACS standard, the most demanded in Europe. The plans to invest 3.4 billion pesetas in R&D during the four-years 1995-1998 at the Biscay plant made the BaCo the fourth largest production center for Ericsson's analogue terminals, after Sweden, the United States and the UK. At this plant, Ericsson hoped to strengthen its penetration of Europe and Latin America - 90% of production for export - and to house the world's center of competence for R&D and the manufacture of fixed and mobile terminals[67].

As far as the reasons for believing the multinational's maximum authority are concerned, the Basque Autonomous Community offered a "very positive environment for industrial activity" and "a very high level of training for workers". Nothing could be further from General Electric's assessment

of Asturias' candidacy, when the American multinational preferred an area without a strong industrial culture, i.e. Murcia, to one that did have one, i.e. Asturias. If we translate for a better understanding, the favorable environment meant strong support from the Basque Government, in full agreement with Ericsson's vision of long-term investment[68].

The second half of 1996 and the start of the following year are marked by restructuring and specialization processes. At that time, Ericsson was looking at eight drivers that could affect the information industry, including general aspects of the economy, regulation and technological change. These were globalization and internationalization, the continuing deregulation of telecommunications, increasingly capable microelectronics, the expansion of the computing paradigm, the Internet, consumer orientation, mobility, and the increasingly blurred boundaries between telecommunications, media and data[69].

Ericsson resumed the restructuring and concentration of activities with a reorganization of the radio activities in Spain. This multinational absorbed the company Sistemas Avanzados de Telecomunicaciones S.A. (SATESA), which inherited from a previous restructuring of INTELSA's segregated assets, oriented to the private telecommunications markets, and which were used to market sophisticated equipment for the Ministry of Defense and other institutional clients. The operation culminated in the conversion of SATESA into Ericsson Radio, the concentration of Ericsson's radio cellular section in Spain into a single head office and the transformation of Zamudio's technology center into an autonomous division of Ericsson Radio[70]. In 1996, the latter gave rise to Ericsson INDELEC S.A. with a capital of 2,000 million pesetas, fully paid up[71].

At the outset of the following year, Ericsson reorganized the entire group by specializing in segments where technology was the most competitive factor to the detriment of those with low technology content, whose activities were transferred to partners in global schemes. The Spanish subsidiary then completed the renewal of its industrial model by setting up the companies SCI and Chatham, which focused on the assembly of plate components and the manufacture of metal cables and cabinets[72]. The workforce remained constant at an average of 3,300 employees, not without a substantial change in its composition according to qualifications and age[73].

In 1998, Ericsson planned to develop its new center in Zamudio for an amount of Ptas. 5,580 million in investment and 170 new jobs. The Basque Government allocated Ptas. 787.7 million to this project, an amount that was not paid due to the company's failure to comply with its obligations in both investment and employment areas[74].

Difficulties therefore loomed, but the large investments made or announced did not foreshadow the end or guard against the gale that accompanied the bursting of the dot.com bubble. A long series of vital events took place in 2001. The most general was the general crisis of the Swedish manufacturer, whose losses of 69,859 million pesetas at the end of the third quarter led to the announcement of the elimination of 17,300 workers (16% of its worldwide workforce) to recover lost profitability and stop the fall in profits.

The relocation was in full swing under the fabless pattern or companies without factories. In early 2001, the Swedish giant made public the decision to transfer its entire factory and manufacturing operations to Flextronics in a deal valued at $5 billion a year[75].

In 1999-2003, Ericsson suffered heavy operating losses and radical restructuring, including relocation, outsourcing and downsizing. In the wake of the unexpected slowdown that followed years of explosive growth in mobile phone sales, Ericsson decided to reduce its industrial activity in Spain, resulting in job cuts at its Zamudio plant. The Swedish multinational informed the Basque government and public opinion of its intention to seek a buyer for the Zamudio plant. Because of the interest of the emblematic Mondragón Corporación Cooperativa (MCC) group in studying the viability of a cooperative project in which the Ericsson plant could partly or totally fit, the two parties sealed a preliminary agreement whereby the multinational undertook to maintain employment until a new partner was found[76].

Towards the end of the year, INDELEC signed a preliminary agreement with MCC to integrate the Zamudio plant into the Mondragón group, under the name of Bilbao Technology Centre. However, due to the alleged lack of a clear industrial and technological plan, the unions and the works council rejected the proposal. Ericsson En responded with an increase in job cuts to 850, the bulk of which were through relocation to other companies and the rest through early retirement,

voluntary layoffs, relocations and forced redundancies. The areas most affected were radio, operations and IT support.

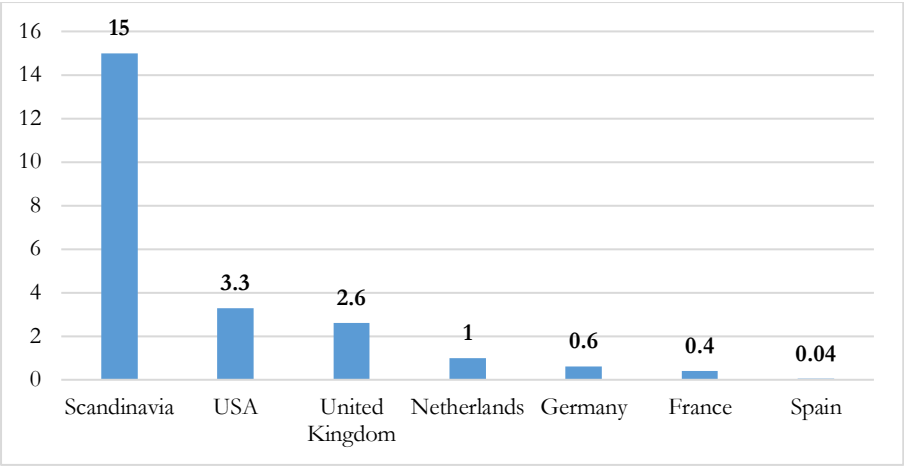
In the same year, Ericsson reached an agreement to outsource the manufacture of mobile terminals to a US group based in Singapore and later partnered with Sony to merge the mobile phone manufacturing of both into a newly created company. This was born under the name of Sony Ericsson Mobile Communications, later renamed Sony Mobile Communications, in an operation that presented a new challenge for Nokia[77].

It is now time to address the issue of spin-offs from INDELEC-Ericsson. About thirty former employees of the Ericsson plant in Zamudiocreated Owasys, which manufactured adapted mobile terminals and wireless communications systems between machines. The initiative was well received but lacked product and did not produce money. The considerable delay in devising a solution and having the product available led to an unsatisfactory response from the market, which led to the suspension of payments in 2005 and the thinning out and entry of new partners to revive it[78]. The remaining companies formed as spin-offs from INDELEC-Ericsson were P4Q (1999), specialized in engineering and manufacturing of electronic systems, in Alonsotegi, and Trelec BTC in Sondika. Both companies collaborated with Owasys and the latter acquired a stake in P4QINDELEC was split into three units of different characteristics from the activities of the Swedish multinational[79].

## Conclusions

This article addresses, from a case study - that of the radio-telephone company INDELEC-, the interweaving of multinational FDI and an autonomous administration to recover the industrial fabric thanks to the introduction of a first-rate technology in a depressed area (BaCo) during the industrial reconversion of the early 1980s, later consolidated as an industrial economy. The study aims to clarify relevant issues in business history and in the reconstruction of the impact of reindustrialization policies on sectors with high added value. The presence of multinationals and their erratic transfer of capital and technology add even more value to this case. The article is set against a backdrop of various transitions: Spain's entry into the European Union, the liberalization of telecommunications and the end of the service monopoly, together with the consolidation of a decentralized territorial model. Its theoretical support lies in qualified sectorial studies of an aggregate nature, while methodologically it presents a story from the perspective of business history. The empirical evidence comes from both business sources and the various public administrations, which allow us to get to the heart of the processes and see their complexity. In substance, the article traces the evolution of a company in the ICT sector, in general, and of communications in particular, within the framework of the confluence of the strategies of multinationals and industrial policy, including that of the monopoly telecommunications operator itself. On the Spanish side, the strategy behind the creation of INDELEC was to equip itself with an industrial fabric capable of supplying the equipment necessary for the deployment of public mobile telephone networks in Spain, and not so much that of competing for other markets as that of private mobile telephone trunking systems[80]. The key case analyzed and the examples given show elements that differ from the strategy followed by multinationals on other occasions. It is not a minor contribution to highlight the importance, and at the same time the insufficiency, of the industrial policies of the technologically dependent countries, due to the submission to the multinationals, owners of the technologies and the capital. Lastly, the work reveals that the experience was not a total failure, since it had a moderate spin-off effect, visible in the appearance of some small companies, some of them very dynamic, which, at least in part, allowed the know-how accumulated over years in mobile telephony to be capitalized on.

In short, the differential contribution of this study with respect to other similar studies lies in its business perspective and comparative approach, as well as in the combination of regulatory elements, industrial policy and business strategies emanating from various institutional agents. Undoubtedly, the access to new sources and the availability of documentation forbidden until now will make it possible in the future to delve into various aspects, such as the relations between multinationals and public administrations or between multinationals and the subsidiary, without forgetting intra-company forms of technology transfer.




**Annexe 1. Car phones in a group of industrialised countries. Penetration rate per 1,000 inhabitants**

## Glossary

**Radio spectrum**: defined as a limited natural resource, composed of all radio waves (in frequency bands between 9 kHz and 3000 GHz) that propagate through space without the need for artificial guidance.

**Standard:** a common language that allows multiple systems developed independently by different manufacturers to interoperate. In the ISO definition, a telecommunications standard is a set of technical standards and recommendations that govern transmission in different communications systems

**GSM (Global Standard for Mobile communications)**: a second-generation (2G) digital mobile phone standard and the de facto standard used in Europe. It is implemented in the 800, 900, 1800 and 1900MHZ frequency bands. The most common frequency used is 900MHZ, followed by 1800MHZ.

**Microprocessor:** computer brain designed to execute programs from simple logical instructions and operations. It consists of a chip, a type of electronic component inside which there are thousands (or millions) of electronic devices called transistors.

**SMD (Surface Mount Devices) modules**: electronic surface mount devices whose components are mounted on the surface of the printed circuit board (PCB) and which are used to manufacture electronic circuit boards according to a technology that allows the use of both sides of a PCB.

**Nordic Mobile Telephone (NMT):** a "cellular" public mobile telephone system, based on the theoretical concept of cellular radio communication, conceived by D. H. Ring in 1947 and developed by AT&T during the 1970s.

**Pageboy:** a simple device used in the mensafonic or paging service by which one-way messages from the switched telephone network are transmitted to mobile location subscribers, which was first marketed in Spain in 1973 (Pérez Yuste).

**Radio search:** according to the ITU, this is a one-way system of selective signalling without speech transmission, designed as an extension of the telephone network; its main modes of operation are automatic calls to a common terminal, automatic calls with secondary audio-frequency signalling and radio search calls via a mobile telephone operator.

**Secraphone:** a device first named scrambler telephone, that transposes or inverts signals or encodes a message in the transmitter to make it unintelligible in a receiver that is not equipped with a properly configured decoding device.

**Mobile telephony:** based on different systems or standards, each with its protocol or language; comprises access networks, a central network, system elements and network architecture.

**Total Access Communications System (TACS):** an analogue cellular telephone system implemented mainly in Europe and modelled on the AMPS system in the United States. In the UK, ETACS (Extended TACS) transmitted in the 871-904 / 916-949 MHz band. Narrowband TACS (NTACS) used the 860-870 / 915-925 MHz band.

**Trunking:** land mobile radio communications in closed user groups used between general transport vehicles or other more specific ones (radio taxis, security companies or ambulances).
**UMTS (Universal Mobile Telecommunications Service):** a 3G standard that allows a theoretical data throughput of up to 2 Mbps.
**Videotex:** an interactive application capable of disseminating, via a telecommunications network, information in paginated form served by a computer system and displayed on a terminal and a telephone line.

## End Notes

[1]OECD (2011), pp. 76-77.

[2]López and Valdaliso, 2011, pp. 317-336; Valdaliso and López, 2008, p. 5; Valdaliso 2010, pp. 194 221.

[3]An Annual Report by INDELEC, provided by Francisco Lacha, is priceless material. Neither the National Library nor other institutions, which are usually depositories of essential materials for the study of companies, keep annual reports or financial reports of the latter. Around 1995-1996, the information agency Axesor classified INDELEC among the companies with a capital of over 100,000 euros, employment of between 11-50 and sales of the order of 3 million euros.

[4]Liao, 2016, pp. 10-25.

[5]For example, Directive 87/372/EEC (known as the GSM Directive), adopted in 1987, reserved the 900 MHz band for use by GSM systems, but successive amendments opened up these bands to other systems.

[6]Corral, 1992, p. 179.

[7]Hearing of the Director-General of the SPRI to report on the recent International Telecommunications Congress, file 05/06/03/0323, Commission, Fifth Legislature - Committee on Industry and Agriculture, 25/06/1996. Nevertheless, electronics and telecommunications, with 35%, was the sector least devoted to the foreign market, with 35% of its turnover, compared with the sectors with the greatest international projection, led by aerospace with 90%, and followed by the automotive industry, machine tools and casting, with 65%, 60% and 55%, respectively. SPRI, 2006, pp. 9-12.

[8]There is no universally accepted standard definition of small businesses; therefore, there is great confusion in determining the characteristics of these enterprises: Alsaaty and Makhlouf (2020), pp. 1,908-1,916.

[9]Radiocommunication Bureau of the International Telecommunication Union, 2010, p. 7.

[10]Castells et al. 2009, p. 1.

[11]Assemblée Nationale, Réponse du Ministère des PTT à la Question N° 35,240 de M. Schreiner Bernard (Socialiste-Yvelines), Journal Officiel, 11/1/1988, p. 101 and 14/3/1988, p. 1,194.

[12]In August 1992, radiophone penetration rates exceeded 22 per 1 000 inhabitants in the United Kingdom, 9 in Germany and over 6 in France: Réalités industrielles: une série des Annales des mines, April 1993, p. 66.

[13]At the regional level, figures are known for mobile services, considered to be value-added services; in Catalonia, for example, there were some 25,000 users around 1991: Recober et al. (1991).

[14]Ayres 2014, p. 157. Some equipment was primarily portable telephones suitable for vehicles, as was the case with INDELEC 6222: ABC, 23/7/1991. Philips advertised its TMA PHILIPS AP 4000 car phone as an advanced technology, equipped with a wide range of accessories and a free maintenance service for three years at its points distributed throughout Spain: La Vanguardia, 3 June 1987 and 27 December 1989. During Barcelona's local festivities, the gas entreprise Butano organised a large fleet of vehicles equipped with radiotelephones to respond quickly to emergencies or breakdowns: La Vanguardia, 24 September 1967. In addition to car telephones, there were also bus telephones on wheels, in short: Direction des télécommunications des réseaux extérieurs 1983; Régie autonome des transports parisiens 1984. The Poctel 2000 was a mobile UHF duplex terminal designed for the Radiocom 2000 system and manufactured from 1987 by ALCATEL: Electrical Communication, 60-61, 1986, p. 327; Le Monde, 26/7/1988.

[15]Recober et al. (1991).

[16]The superiority of the ERMES standard lay in its ability to allow roaming over a wide geographical area and its greater potential for data transmission than the POCSAG: Wireless Cellular Monthly Newsletter, 1, 3, October 1991

[17]Martí Recober et al., 1991. Spain, with the IBERTEX service, lagged behind the UK's Prestel service (1979) and the French videotex, supported on a high potential network and served by the very simple and cheap Minitel terminal. At the beginning of the 1990s, it was a long way from France, which had a capacity 30 times greater in terminals, 50 times greater in service centres and 100 times greater in hours per month: Fernández and González, 1992, pp. 3-4.

[18]*El Economista*, 3/03/2007; Author's interview with José Miguel de Diego Rodrigo, 11 March 2019. Vitelcom was described as a "giant with feet of clay": Sur, 26 November 2017. On the occasion of the Barcelona Olympic Games, 2,050 terminals and closed group radiotelephony equipment were installed; some of the terminals were awarded to INDELEC but exceptional events could not provide a firm basis for long-term survival: VV.AA. 1996, p. 296; Grau, 1992, p. 63.

[19]Council Resolution 88/C 257/01 (June 1988) on the development of the common market for telecommunications services and equipment until 1992; Commission Directive 90/388/EEC (June 1990) on competition in the markets for telecommunications services, which abolished "exclusive or special rights for the provision of telecommunications services" for all services other than voice telephony - telex, mobile telephony, radio messaging and satellite communications: Silván, 1992, pp. 1-9.

[20]In 1994, Gary Hart, US Senator, together with representatives of the US West and Time Warner companies, met with the President of the Basque Executive to explore their investment in a possible network: Basque Government, 2004, p. 428. The American side, which included the vice-president of US West, Maureen O'Ryan, who was also a member of the US government's international economic cabinet and advises Vice-President Al Gore on American investment policy abroad, estimated the investment plan at some 50 billion pesetas. The investment proposal was based on the characteristics of the project-good economic expectations-and on factors inherent in the autonomous community: provision of communications infrastructure. US West was one of the owners of Time Warner - the largest communications group in the world - and a partner in the cable operator TCI: El País, 21 May 1994. EUSKALTEL adopted Ericsson's Packet Backbone Network (PBN) solution to extend its data backbone: Ericsson, Press release, 21 July 2003.

[21]The Basque Telecommunications Association, which originated from the Association of Electronic Industries of the BaCo, was renamed the Association of Electronics and Information Technology Industries of the BaCo (GAIA). The mission of this association was to coordinate and implement projects of interest to all companies, including investment in research and development, and the management of the daily activity of the "Telecommunications Centre": Gil, 2002, pp. 156-163; see also López García and Valdaliso, 2011, pp. 317-336.

[22]SPRI, 2008; SPRI (2006). By 1990 FDI in the BaCo amounted to 51,852 million pesetas. During 1985-1997, this autonomous community ranked quite low in the regional distribution of FDI in Spain (4% of the total), at a great distance from the Community of Madrid (44%) and Catalonia (29%): Díaz 2001, p. 10; in 2001, FDI in this region reached 1,981 million euros, 4.11% of that in Spain as a whole, and came from the USA, France, Luxembourg, Germany, the UK and the Netherlands: Gobierno Vasco, 2004, p. 370.

[23]López and Valdaliso, 2011; Valdaliso and López (2008), pp. 1-20; Oyon, 2014, p. 4; VVAA, 2010, pp. 38-42. With no room for detail, we highlight the network of relations generated by participation in international meetings. This is the case of the talks held by numerous multinationals with companies from the Basque Country during the 1996 International Telecommunications Congress: Appearance of the Director General of the SPRI, at the request of the Commission to report on the recent International Telecommunications Congress, file 05\06\03\0023, Basque Parliament, Commission, V Leg., 25.06.1996.

[24]Ernst & Young, 2008, p. 11.

[25]Appearance of the head of the SPRI at the request of the Commission, under the request made by the representative of the Joint Parliamentary Group-AU, to report on the debt situation of the companies in which it participates with resources from the general budget of the Basque Autonomous Community, File 04/06/03, IVth Legislature, Committee on Industry and Agriculture, 17 February 1994.

[26]Tribunal Vasco de Cuentas Públicas, 1997.

[27]Tribunal Vasco de Cuentas Públicas, 1997.

[28]SPRI, 2006, pp. 32-36.

[29]Government Communication on the document "Industrial Policy. General Framework for Action 1991-1995". (Motions for resolutions) (5/10.08.00.0001), Official Journal of the Basque Parliament, 33, 21 July 1995, p. 1.491.

[30]Decree 289/1996 of 17 December 1996, regulating the Ekimen programme, on financial aid for productive industrial investment that creates Jobs: Official Gazette of the Basque Country, 246, 6.249, 23/12/1996. Between 1996 and 2000, 161 projects with a total investment volume of PTA 280 984 million benefited from the Ekimen programme, generating 10 895 direct jobs: El País, 20 January 2000. Socade was the only one of the seven funds integrated into the Gestión de Capital Riesgo of the Basque Government's Risk Capital Management (SGECR) and focused on SMEs that was oriented towards strategic industrial projects. Between its constitution in 1993 and 2001, Socade managed capitals of over 30,05 million, was a shareholder in the special steel manufacturer GSB and collaborated in various reorganisations of basic sectors for the industrial fabric of the autonomous community: Cinco Días, 12 August 2002.

[31]Gobierno vasco, 2004, pp. 380-381.

[32]Dossier 05/06/03/0310, V Leg., Committee on Industry and Agriculture, Journal of the Basque Parliament, 19 October 1995. While announcing the immediate closure of the Zierbena plant specialising in carbon black, Cabot plans to double its production in Shanghai, China: ICIS Chemical Business, 16 May 2003; Castillo, 1987, pp. 129-155.

[33]File 05/06/03/0310, V Leg., Committee on Industry and Agriculture, Journal of the Basque Parliament, 19 October 1995. Precise and HR Industries had a turnover in the United States of some USD 2.5 million and USD 1.3 million respectively. It was downgraded to the category of "workshops" or business " beach-bars ("chiringuitos") by the opposition in the Basque Parliament.

[34]Plaza, 2000, p. 4.

[35]Hearing of the Regional Councillor for Industry, Agriculture and Fisheries, at his request, to report on the "Grotjhon Precise Connection International Project", File 05/06/2003, V Leg.

[36]CTNE, *Annual Report* 1971, p. 37; for an evolution of the Service and its technical characteristics, see Elias, Berenguer and Mataix, in Calvo, 2016, pp. 85-158. On motorways, the service required pairs of emergency posts, radio link repeater stations and mobile network equipment: CTNE, Annual Report 1982, p. 22.

[37]CTNE, *Annual Reports*. A mobile call centre was used for the first time on the cycling tour of Spain, the first power stations were tested in portable containers and the first mobile radio links on trailers were incorporated: CTNE, Annual Report 1972, pp. 43-44. Belgium and the Netherlands (1965) advanced the analogue radio messaging service with the Sémaphone, later available in Luxembourg (1981). France fine-tuned its Eurosignal analogue standard in 1975 and the UK did the same three years later with a code and format for national radio messaging systems (large capacity and wide-area) developed by a Post Office group called the Post Office Code Standardization Advisory Group (POCSAG). It was adopted in 1981 as an international standard by the Consultative Committee for International Radio (CCCRI) in competition with the other third-generation standards - the NEC and Motorola Golay: Soret (1991), p. 75; Boucher, 1992, p. 265; Bekkers, 2001, p. 417.

[38]Elias, Berenguer and Mataix, in Calvo, 2016, pp. 85-158. No doubt, these are the mobile terminals for individual use, which the CTNE strictly reserved for senior officials: Conversation of the author with Luis Solana Madariaga (former president of CTNE), Madrid, 8 March 2016.

[39]CTNE, *Annual Reports* 1974, p. 16; 1975, p. 19 and 1977, p. 12 and 1990, p. 11; Telefónica, *Annual Report* 1990, p. 30.

[40]Almost three years elapsed between the launch of the commercial offer of the GSM service in the European Community at the end of 1992 and the start of the commercial exploitation of the GSM service by Telefónica, followed within a few months by the International Alliance of Telephone Networks SA, originally named Airtel Móvil: Official Journal of the European Communities, 76, 18 March 1997, pp. 19-29. Ericsson Spain supplied the first GSM mobile telephone system to Telefónica, for which Ericsson was the main supplier. After the opening of the market to competition with the granting of the second mobile phone licence, Airtel (now Vodafone) in 1995 and Amena in 1998 became customers of Ericsson.

[41]Calvo, 2017, pp. 51-62. For context, see Guillén, 2002 and Calvo, 2016.

[42]Calvo, 2016. Radio Industria Bilbaína was founded during the Second Republic by national capitalists - Antonio Muñoz Villamil - and foreigners - the Dutch Lamberto Lucas and the Belgian Gustavo Fraikin - and employed foreign technicians: Calvo, 2014, p. 87. HRM advertised itself as a supplier of TSH, telephones, self-alarms, direction finders, fish and bottom detectors, radar and public address systems. It had management and offices in Madrid and 30 inspections in Spain: Ingeniería Naval, July 1967, p. 7.

[43]In collaboration with the SPRI, Telefónica built a teleport as the centre of the entire Basque Country's telecommunications system: Cambio 16, 999-1001, 1991, p. 16.140.

[44]Telefónica, *Minutes of the Board of Directors, 28/3/1984*; Telefónica, Annual Report 1984, p. 39. By Royal Decree 2206/1980, of 3 October, on the reconversion of the special steel sector, the company Aceriales, S.A. was created, in which seven of the thirteen companies that made up the subsector participated, representing a quarter of the turnover and 85% of the workers in the subsector: Pablo Díaz-Morlán and Sáez-García (2015), p. 14. In 1983 Aceriales created DENAC, specializing in infrastructure and logistics, to offer a comprehensive service to business initiatives and, like British Steel, to counter the layoffs resulting from steelworks closures in the Basque region and in response to both trade union and autonomous government pressures: European Communities Commission (1989), pp. 195-198; El País, 17 November 1983. Some indications point to the continuity over time of this orientation towards the international market, as shown by the participation in a delegation of companies in the important market of France, reported elsewhere: Basque Government, 2004, p. 428.

[45]Economic historians have recorded its creation as follows: "[SPRI] also promoted the creation of mobile telephony by launching the Indelec-Ericsson project in 1984": López García and Valdaliso, 2008, p. 5. The international literature places the company in Bilbao without any hesitation: Meurling and Jeans, 2000, p.

389. Interestingly, the name coincided with that of Indelec Holding AG, a subsidiary of the Swiss Bank Corporation: Prior notification of a concentration (Case No IV/M.789 - Enderly/SBE), (96/C 187/06), Official Journal of the European Communities, 27 June 1996. The HRM works council stated that due to viability issues, Telefónica intended to halve the workforce and was openly opposed to the new company which, while creating 122 jobs, left 200 workers facing an uncertain future: El País, 14 April 1984. In 1985 SPRI, the Provincial Council of Bizkaia and the Zamudio Town Council formed the Public Company Parque Tecnologico-Teknologi Elkartegia and the park, strategically connected to the airport, was a pioneer in Spain: Iraila, September 2010, p. 28.

[46]The integration into INDELEC of Philips' sales network, technical support, installations and systems engineering department working in the field of mobile radio communications took place at the beginning of 1986: INDELEC, 1986, p. 5.

[47]The SPRI had a majority stake in the founding share capital of the Zamudio Technology Park, with 51%; the rest was shared between the Provincial Council of Vizcaya (48%) and Zamudio City Council (1%). Subsequently, the SPRI had to take an additional stake, so the composition remained as it was: SPRI, 74.9%, Biscay Provincial Council, 24.53% and Zamudio City Council, 0.57%. Regarding the share capital of the Zamudio Technology Park, file 07/10.05.03.0232, 19th December 2001; Ondategui (2001, p. 89) rounds off the numbers: Basque Government (SPRI) 74.8; Biscay Provincial Council 24.6; Zamudio Town Council 0.6. A viability plan for the three main national industries in the consumer electronics sector provided for a credit line for the creation of a new national company in the so-called brown sector, which includes radio, television, hi-fi equipment and household electronics: El País, 10 August 1982.

[48]Constitution of Integrated Electronic Control (CEISA) with 44 million pesetas. For Philips: European Communities Commission, 1989, p. 192; variants of the stake in INDELEC - Telefónica, Philips and the Basque Government with 30, 20 and 26 % respectively: Castells, 1986, p. 148; interestingly enough, Philips strengthened its weight in INDELEC before being replaced by Ericsson as a technological partner: Computer Business Review, 26 April 1989; El Pais, 16 February 1993. In 1995, Telefónica had a 20.14% stake in the share capital: National Securities Market Commission, 4.915, 19 April 1995. In 1986 INDELEC achieved a turnover of 1.205,664,879 and the following year it exceeded 2 billion pesetas, almost 66% more than in previous years: INDELEC, 1986, p. 5; *AHCIET*, 22, 1987, p. 133.

[49]INDELEC, 1986, pp. 8 and 11. It is worth noting the introduction of production flexibility techniques with effects on the reduction of stocks in progress and those of the finished product: INDELEC, 1986, p.

[50]INDELEC, 1986, p. 5; *El Economista*, 15/12/2019. The winning consortium was formed by Airtel-Reditel-Sistelcom: *Expansion*, 3 December 1994. In Madrid there were seven companies (Audio Centro, Autophone, Auto Radio FM, Maiden, Radio Automóvil, Siteleg Radio and Teleco Ibérica); in Alicante one (Telecomunicación de Levante; in Seville one (Visa Sur Telecomunicaciones): ABC, 29 October 1990; Valle de Elda, 27 October 1989. The sales team reached a total of 27 employees at the end of 1986: INDELEC, 1986, p. 8.

[51]We deduce the assertion from testimonies of protagonists, such as the one referring to a distribution, installation service and maintenance contract with J.J.N.Electronica, a company with four employees.

[52]ABC, 27 February 1987. Among the first R&D projects, three stand out, one of them alone (development of an FFSK interface with the on-board computer for urban bus traffic control systems). Two projects were carried out in collaboration as part of an international project (development of a CAD system for software development and a chip in CMOS technology that allowed software monitoring -watchdog-, information on Reset Origin and a reduction of control unit consumption by half, a function of great importance in the designs of future radiotelephones): INDELEC, 1986, p. 7. INDELEC became an official distributor of the paging service in Telefónica's new Mensatel project: ABC, 20 October 1989.

[53]José Miguel de Diego Rodrigo, Author's interview, 11 March 2019. Initially, the department was expected to have a total of 16 full-time employees; soon the experience of the graduate staff was strengthened with training stays in factories and centres in various foreign countries: INDELEC, 1986, p. 5.

[54]ABC, 26 October 1989; Fernández de Santos, 2010. Since 1986, INDELEC's engineers participated in the development of a new mobile terminal, a project that was carried out in Holland. INDELEC received a public subsidy from the CDTI for the development of terminals for the ERMES project: CDTI, 1990, p. 76.

[55]Author's interview with José Miguel de Diego Rodrigo, 7 March 2019.

[56]Written answer to the question put by the representative of the Izquierda Unida/Ezker Batua/Berdeak group to the government regarding the implementation of the Ainhoa Project, Basque Parliament, file 05-05-03-69. At the end of the 1980s, Ericsson's subsidiary in Spain had carried out a restructuring - similar to that of Alcatel-Standard Eléctrica- to strengthening and making more flexible the structure and activity of the entire group through a holding company - Ericsson S.A. - and segregating the

activities of different markets to adapt to the end of Telefónica's monopoly. Ericsson S.A. was made up of four companies: the historic Intelsa, Advanced Telecommunications Systems and Engineering and Construction Networks (Redinco), which specialises in infrastructures. Redinco took control of two units: Fibroco, a company producing optical fibre cables at its plant in Santa Perpetua de Mogoda (Barcelona), and Ingeniería de Telecomunicaciones e Instalaciones (ITISA), devoted to the installation of networks and in which the Swiss company Cables Carailloz had a stake (48%): El País, 25 October 1989.

[57]Payments per financial year: Pts 285 million in 1990 (Phase I); 1991: Pts 249 481 149. (phases I and II); 1992: 499,544,723 pts. (phases I and II); 1993: 423.091.619 pts. (Phase II); 1994: 117.362.942 pts. (Phase II); details of the companies responsible for the maintenance of the other communications systems: ALCATEL (transport); ALTEL (conventional pagers and repeaters); SIEMENS (telephony) and KEYTRON (RACAL communications): Reply to the question for written answer put to the government by the representative of Izquierda Unida/Ezker Batua/Berdeak group, concerning the operation of the Ainhoa project, Basque Parliament, file 05/05/03/0269.

[58]INDELEC advertised several types of equipment: the I7-1050, the laptop that combines advanced technology and communication design in a pocket; the I-4000, the reliable solid car phone with the longest range, the best-selling convertible in Spain; and the I-6222, the most powerful laptop on the market that can also be adapted to your car: ABC, 23/7/1991. Tecnophone manufactured portable transceivers (TMA-900-A) under its own brand and under the Olivetti brand: BOE, 25 April 1991. It does not seem appropriate to qualify INDELEC as a company of considerable entity and size: Moreno, 2005, p. 531.

[59]EEC, No 4,257/88: Official Journal of the European Communities, 86/29, 30 March 1989 Senior managers in the sector acknowledged the difficulties ("downturn") of the company: Congress Sessions Daily Journal, 20 May 1992, 18 – Commissions, p. 18.

[60]*El País*, February 16, 1993; Ericsson expansion in Europe: Ericsson, 1995, p. 6.

[61]The SPRI granted INDELEC a credit of PTA 250 million on 14 June 1994 and mediated when the Basque Government took a 40% stake in INDELEC's capital increase. This contribution was conditional upon INDELEC paying off the abovementioned 1994 loan in full. SPRI was also authorised to waive its pre-emptive right to acquire all the shares in INDELEC held by Telefónica. The authorization was extended to grant a temporary option - for a period of 18 months - to purchase all its shares in INDELEC from Ericsson: Official Gazette of the Basque Country, 213, 9 November 1994.

[62]Landata was incorporated in 1985 by IT professionals to make computer systems compatible, a pending problem in companies. After the disastrous years at the end of the decade and beginning of the 1990s, caused by the advance of computer technology, Proindesa, the industrial branch of Iberduero, entered the capital (40%). The new partner opted for telecommunications engineering in the private network business, successively for data and voice. In 1992, the IBV Corporation, made up of BBV and Iberdrola, replaced Proindesa as a partner in Landata according to a trend of shareholding, reaching 74.25% in the first step and 93.92% in 1998. In addition to its ability to position itself in business niches with high added value - telecommunications engineering services, mobile telephony and cable television - it has been able to take advantage of the favourable wind of telecommunications liberalisation and the mobile telephone boom. Between 1993 and 1998, it multiplied its turnover by 18, from 731 million pesetas, and its workforce increased fivefold. The emergence of digital networks contributed strongly to the sales boom and, more specifically, an agreement with Ericsson in1995 whereby Landata bought the exclusive marketing and distribution rights for INDELEC's mobile phones, which went from selling 11,000 mobile phones a year to half a million in 1998: El País, 14 September 1998.

[63]Telecompaper, 29 March and 2 November 95. The company's turnover in 1994 reached 3,052 million pesetas, with an increase of almost 40%; the capital, estimated at 2,025 million pesetas, was divided between the SPRI (40%), Ericsson (29.3%), Telefónica (20.7%) and Bilbao Bizkaia Kutxa Banking Foundation (BBK) (10%): PCWorld, 1 March 1995.

[64]Telefónica, Memoria 1995, p. 3. Ericsson paid Pta. 420 million for the shares at par value: Spanish National Securities Market Commission, 4,915, 19 April 1995.

[65]VVAA, 2015, pp. 139-140.

[66]VVAA, 2015, pp. 139-140. ACS was a standard derived from the AMPS, developed by Bell Laboratories and the US AT&T research centre. INDELEC came to be structured in three divisions to specialize in products that were very different in their application: FCT (Fixed Cellular Terminal), oriented to the markets of underdeveloped countries and Ericsson's favourite, robust data modules and mobiles, a product that was very suitable for certain services and that counted among its clientele the firemen of New York: Personal interview of the author to José Miguel de Diego Rodrigo, 7 March 2019.

[67]Ministerio de Industria y Energía, 1996, p. 120. In the 1995 financial year, Ericsson España increased sales and exports by 40% (to $735 million and $33.6 million, respectively). Ericsson expected growth to continue in 1996, with a slight downward correction. The Zamudio plant produced components for the

stations that were manufactured in Sweden, Australia and the UK. In 1996, the initial plans for INDELEC to produce GSM mobile phones and base stations required by Telefonica and Airtel were not realised: Computer Business Review, 3 October 1996. The factory was intended to be the sole production site for NMT and analogue phones under the TACS standard - both "cellular" public mobile phone systems -, a manufacturing site for SMD modules for digital phones and solely responsible for R&D. INDELEC had at that time the capacity to produce around 700,000 units: ComputerWorld, 20 September 1996. There was also talk of a somewhat more extensive industrial plan (1995-2000 period) with investment figures of 6 billion pesetas and the creation of 450 new jobs: El País, 23 April 1996.

[68]*El País*, 14 September 1996. As it is known, General Electric valued positively the industrial culture of Asturias but it preferred the most agricultural regions with a budding industrial culture: Junta del Principado de Asturias, II Legislatura, Comisión de Industria, Energía y Comercio, Daily Sessions, 048, 25 October 1988.

[69]Ericsson, 1996, p. 12.

[70]Ingemar Naeve, in Expansión, 1 December 2010; ComputerWorld, 20 September 1996; Fernández de Santos, 2010; El País, 25 October 1989.

[71]The Board of Directors was formed by Jesús Javier Aguirre Bilbao as Chairman, by Alfonso Castresana Alonso de Prado as Secretary and by the directors Naeve Ingemar, Rafael Lindgren Raimo, all members of the body between 1/07/1996 and 1/1/2001: Interactive Commercial Information from the Spanish Commercial Registries, Bizkaia Commercial Registry, page bi-2,589, volume 212, sheet 34.

[72]Ericsson's outsourcing plans, as part of the global reorganisation of its activity, were closely monitored by the Madrid Regional Government, due to the establishment of the multinational there: Ericsson's outsourcing plans, as part of the global reorganisation of its activity, were closely monitored by the Madrid Regional Government, due to the establishment of the multinational there: Diary of sessions of the Madrid Assembly, III Leg. 68, 14 November 1991, p. 1.206.

[73]In 1990, around 70 % of the labour force consisted of workers, which had been reduced to 10 % by the end of the decade. Ericsson España's workforce increased steadily during the decade, especially by hiring technicians and engineers for the mobile phone section, while rejuvenating itself through the closure of the Leganés (Madrid) plant in 1998 and 700 redundancies, so that 52% of the workforce was between 26 and 35 years old. The workforce of Ericsson España remained at 3,700 workers, 37.8% of whom were engaged in technology development; the company's downsizing coincided with adjustment plans at Siemens: Sánchez Reinón, 2002, p. 1.

[74]Written answer by the Councillor for Industry, Trade and Tourism to the question posed by Ms María Teresa Rodríguez (Basque Socialist Group-Euskal Sozialistak), Official Journal of the Basque Parliament, 65, 18, 10, 2002, p. 6.494.

[75]Ericsson's revenues totalled around $12 billion in 2000 and were estimated at $20 billion the following year; Flextronics had 150 factories and over 70,000 employees in 27 countries: New York Times, 15 February 2001.

[76]IGI, 2010, p. 648. Profitability fell by 89% in the first quarter of 2001 and profits climbed from 109 billion to 11 billion: El País, 27 June 2001; Basque Parliament, Receipt of written reply from the Government, 26 September 2001.

[77]*RedesTelecom*, 29 October 2001; López et al., 2002.

[78]They were Javier Larrucea and Carmelo Laz together with other three promoters at the head - Fernando Agirre, Javier Jáñez and Gorka Agirre: Testimony of Javier Larrucea.

[79]Author interview with José Miguel de Diego Rodrigo, 7 March 2019; the engineer De Diego was employed for sixteen years at INDELEC through the Philips and Ericsson stages. From the Alonsotegi facility, P4Q opened an innovation centre at the Automotive Intelligence Center in Boroa and a factory in the United States - Albuquerque, New Mexico; it also had a sales office in Madrid and exported to more than a dozen countries worldwide. In the course of 2019, it planned to set up a new production centre in Kunshan, China, near Shanghai, the economic capital of China: Deia, 23 February 2019.

[80]This specialisation was openly recognised by the Chairman of the Board of Directors of Telefónica de España, S. A. (Velázquez-Gaztelu Ruiz): Congress Sessions Daily Journal, 20 May 1992, 18 - Commissions, p. 18.

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