Business History

ISSN: 0007-6791 (Print) 1743-7938 (Online) Journal homepage: http://www.tandfonline.com/loi/fbsh20

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To cite this article: Adoración Álvaro-Moya, Núria Puig & Eugenio Torres (2018): Managing foreign know-how and local human capital: Urquijo Group and the rise of Spanish engineering firms, Business History, DOI: 10.1080/00076791.2017.1413093

To link to this article: https://doi.org/10.1080/00076791.2017.1413093

BUSINESS HISTORY, 2018
https://doi.org/10.1080/00076791.2017.1413093

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Managing foreign know-how and local human capital: Urquijo Group and the rise of Spanish engineering firms

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ABSTRACT

This article examines the long-term impact of foreign multinational firms on the human capital of their host economies, looking into a knowledge-intensive industry, engineering consulting, through the lens of a traditional partner of foreign investors in late developing countries' business groups. Following a case-study approach, the research focuses on two leading Spanish consultants, Tecnatom and Técnicas Reunidas, both founded by Spain's largest private business group, Urquijo, in collaboration with American firms. We show that the organisational structure of the group was crucial to recruiting local talent and developing learning strategies aimed at building specific capabilities and competing in the global market. Our main conclusion is that the enablement of local human capital, the basis of the so-called absorptive capacities, depends to a large extent on local learning strategies, which, as our cases reveal, depend much more on local actors and environment than on foreign MNEs.

KEYWORDS

Foreign investment; business group; spillovers; human capital; learning strategy; absorptive capacity; engineering consulting

1. Introduction

This article deals with two broad issues: the ability of the subsidiaries and local partners of foreign multinational enterprises (MNEs) to absorb and internalise knowledge, and the intermediation role of business groups between foreign MNEs and local human capital. To examine these intriguing processes, we look at a knowledge-intensive activity, engineering consulting, in a late developing country – Spain – whose modernisation was closely attached to foreign investment and business groups.[1] Following a case-study approach, the research focuses on two of today's leading engineering firms, Tecnatom and Técnicas Reunidas. Both were founded by Spain's largest private business group, the Urquijo, in collaboration with American firms. Over the time span in which they were under the control of the Urquijo Group (1957–1974 and 1960–1982, respectively), we investigate the knowledge foundations of their internationalisation and growth, and, in particular, how they learnt from foreign partnerships and the synergies created within and around the business group they belonged to. As encouraged by the editors of this special issue, we apply historical methods to search

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for not only new empirical evidence, but also long-term developments and complex, dynamic processes.

The long-term impact of foreign direct investment (FDI) on the development of local human capital lies indeed at the core of this special issue. As international business scholars and business historians have often observed, there is no strong empirical evidence of such an impact.[2] In contrast, there is evidence of two related processes: the successful transfer of knowledge and capabilities within and among advanced economies, and the disappointing or negative results in less advanced economies, which are usually attributed to inadequate institutions and human capital shortages.[3] To understand how foreign MNEs and local human capital interact with each other, and determine whether and how MNEs help develop managerial and entrepreneurial talent, we propose (1) to shift the focus from the MNE and its home economy to the **host economy, its main business actors and institutional environment;** and **(**2) to go beyond manufacturing industries, traditionally at the core of MNE theory, to look into the less-studied, **knowledge-intensive service firms**. This explains our decision to look inside business groups and engineering consulting firms.

Business groups, broadly speaking a trust-based network of independent firms organised around a family and/or financial institution, seem to have been principal business actors in late industrializing, and usually protectionist, countries.[4] Scholars have indeed highlighted business groups' ability to cope with imperfect capital and labor markets, using their privileged access to foreign technology and capital, on one hand, and local institutions and human capital on the other, to create businesses and enhance entrepreneurship.[5] Their survival in a liberalizing context, however, largely depends on the previous development of what has been called project execution capabilities, that is, being able to apply the existing, usually imported, scientific and technical knowledge to a wide array of customised projects that rely heavily on in-house highly skilled professionals.[6] In our study we look at the Urquijo Group, as it was by far the most successful private business group in twentieth century Spain and the usual partner of MNEs operating in the country. As later explained, its technical and economic research departments (TERDs hereafter) pioneered the development of new activities in the country, including engineering consulting. Urquijo's engineering consulting firms were indeed part of the few that, despite the industrial colossus created through the decades, were able to successfully cope with the liberalisation process initiated in the late 1970s and the economic crisis that followed.

We also argue that engineering consultancy is an excellent platform to examine how MNEs and business groups interact, and how local organisations internalised foreign knowledge as a result. Project execution capabilities, as well as engineering firms, are indeed the basis of the late yet accelerated rise of Spanish MNEs.[7] As explained more in detail in section two, professional service firms, such as engineering consulting firms, apply specialist knowledge to the development of customised solutions to their clients' problems.[8] They deliver, therefore, a customised service based on their professionals' expertise, know-how, and ability to embody knowledge coming from different external sources, such as formal education, clients, temporary partnerships, and technical assistance and license contracts. Cooperation beyond the firm and product customisation are, indeed, related with the absorptive capability and human capital of the firm, among other factors.[9]

Engineering consulting has, furthermore, played a key role in international technology markets since, at least, World War II. American firms in particular contributed strongly from then onwards to disseminate hierarchical organisational structures and standardised

methods, and to train engineers in the developed and developing countries where they operated, including Spain.[10] In spite of its potential to disseminate knowledge across borders, this activity has surprisingly received little attention from business historians and international business scholars.[11]

The experiences of Tecnatom and Técnicas Reunidas provide empirical evidence on this process of knowledge diffusion, in particular of the diverse growth and human resource strategies of local partners to internalise that knowledge. Our decision to focus on case-study research is supported by theoretical debates and empirical results that go beyond our business history background. First, aware of the difficulty to capture FDI spillovers using quantitative data series, as well as of the impact of country-specific variables in international knowledge transfer, international business scholars ask for empirical research at industry and firm level.[12] Second, economic historians have demonstrated that the 'Spanish miracle' of the period 1959–1973 was based much more on a sustained increase of total factor productivity in a wide array of industries than on capital accumulation.[13] Taking also into account that most of the new technology came from abroad (given the low national effort in R&D and the great growth of machinery importation, patents, and license and technical assistance contracts), this suggests that domestic firms somehow internalised the imported knowledge, as already demonstrated for the manufacturing sector between 1960 and 1966, as well as for more recent times.[14] The understanding of this internalisation process requires, however, case-level analysis such as the one we propose here.

Tecnatom was established in 1957 to help Urquijo's energy firms explore the rising field of nuclear energy. Founded on a lasting alliance with Westinghouse and other firms, Tecnatom managed the construction of the first Spanish nuclear plant. The accumulated experience determined its early specialisation on personnel training, simulation, inspection, security, and technical support, growing fast and going international. In the late 1980s, Tecnatom was already the second largest Spanish company exporting engineering consulting services.[15]

In contrast, the origins of Técnicas Reunidas (TR) are closely linked to Lummus Española (LESA), a joint-venture founded in 1960 by the Urquijo Group and the American consulting firm Lummus, specializing in petrochemical process engineering. Taking advantage of Spain's economic developmental policy, which limited the participation of foreign firms in strategic industries, in 1965 the Urquijo Group established Técnicas Reunidas, a fully Spanish firm which ultimately absorbed LESA after several years of close collaboration. The accumulated experience and an ambitious learning strategy allowed Técnicas to embrace more ambitious, higher value-added but also more knowledge-intensive services, such as project management and turnkey projects, and to go international. This strategy helped the Spanish firm to overcome the worldwide industrial crisis of the 1970s as well as Urquijo Bank's collapse collapse in 1982. The company ranks among the top ten engineering firms in its area worldwide.

The article is organised as follows. First the main features and historical evolution of the engineering consulting industry are presented. Then we shift our attention to the Urquijo Group, its organisational structure and technical and research departments, and the dynamics of knowledge creation and internalisation within the Group. Next, we examine the cases of Tecnatom and Técnicas Reunidas, describing their learning strategies and interaction with their American partners, the Urquijo Group, and their institutional setting. A concluding section closes the article.

2. Engineering consulting and knowledge dissemination after World War II

Professional service firms, in general, and engineering consulting firms in particular, are considered key vehicles to enhance corporate competitiveness and national growth.[16] The main reason for this is the very nature of their activity, that is, as explained before, the application of expertise and scientific knowledge (in physics, geology, and other fields) to provide customised solutions according to their clients' needs. This includes a wide array of services, from conceptual to basic and detailed engineering. Whereas conceptual engineering is concerned with the preliminary stages and feasibility of a project, basic and detailed project engineering typically deals with the construction of industrial and energy processes and facilities (process engineering), and public works. Those engineering consulting firms which operate as general contractors, also provide procurement services to their clients, purchasing the necessary equipment and managing and supervising its complete installation. When general contractors also supervise construction works and undertake cost and quality control functions, that is, they are able to integrate and take responsibility for all the functions related to the delivery of a project, they are considered project management engineering consultants. And the industrial facilities that are delivered ready to operate are called turnkey projects. Here the consulting firm, or general contractor, is in charge of the entire planning and execution process. General contractors manage but also are responsible for a highly complex and diversified service that implies strong coordination between staff, clients, suppliers and sub-contracted firms. Because project management and turnkey projects are highly demanding in terms of expert management and engineering knowledge, their most important asset is their reputation for expertise and reliability, which in turn depends on their human capital.[17]

The origins of engineering can be traced back to the construction of major infrastructures in the nineteenth century. The increasing technical complexity and coordination needs of public works such as railways led to the professionalisation and departmentalisation of engineering services.[18] There is abundant evidence of the spread of professional services on basic and detailed engineering and procurement in Europe during the second industrial revolution.[19] However, accelerated growth and globalisation of engineering consulting took place after the Second World War, led by the rise of the oil and petrochemical industries. By engaging in project management and turnkey projects, American companies revolutionised the market. Modern consulting firms tended to become independent firms with flexible organisational structures that allowed the execution of more than one project at a time and the redistribution of people according to business peaks and troughs.

Fast scientific progress, on the one hand, and the project-based nature of engineering, on the other, help explain the recent trend towards specialisation and temporary partnerships between multiple firms. When the engineering firms are multinationals operating with local, smaller partners, partnerships also respond to the need to gain local knowledge and accommodate local governments, who often happen to be the major contractors of engineering works. Although the interaction with clients is a major source of knowledge, partnerships can become effective learning vehicles, particularly in late industrializing countries.[20] This was indeed the case for some of the first large Spanish engineering consulting firms.

The rise of modern engineering consulting in Spain took place in the boom years of the 1960s, fueled by economic liberalisation and a public focus on public works and petrochemicals.[21] The previous decade, however, had already witnessed an inflow of new technical and

managerial knowledge, linked to the American aid programs of the early Cold War. The construction of American military bases as counterpart for this aid prompted partnerships between US general contractors and local firms. This provided Spanish firms with a unique opportunity to learn by participating and gaining first-hand knowledge about project management and American working methods, systems, and specifications. As we explain below, the experience acquired around the US military bases would be crucial to the creation of Urquijo's pioneering engineering firms.

Over the next two decades, engineering consulting flourished in Spain not just within Urquijo but also around the state-own holding INI (Instituto Nacional de Industria), large construction concerns, and foreign, mainly American groups (Lummus, Gibbs & Hill, Foster Wheeler) that usually operated through joint ventures with local partners. Institutional constraints affected the strategy of foreign MNEs, as only companies controlled by nationals were allowed to bid for governmental projects. Indisputably, learning-by-doing in a protected market helped Spanish firms to thrive. However, by the late 1970s most companies still lagged behind their American and European counterparts in terms of size and the range of services offered. Virtually no Spanish company was yet able to handle project management.[22]

3. Urquijo Group: Learning and talent building through organisational innovation

The Urquijo Group emerged around a private bank, Banco Urquijo, founded in 1850 by one of Rothschild's Spanish agents. Owned and controlled by five generations of the aristocratic Urquijo family, this bank became deeply involved in Spain's industrialisation from 1918 through to its own collapse in the early 1980s. Two external CEOs led the group's expansion during the prewar period (Valentín Ruiz-Senén) and the Golden Age (Juan Lladó). The number of participated and controlled firms evolved from 129 and 30 in 1930, to 210 and 65 in 1960 and 290 and 85 in 1974, respectively: between 30 and 40% of Spain's largest firms.[23] This growth was focused, furthermore, on the most innovative and promising sectors, such as engineering consultancy.

After the Spanish Civil War (1936–1939), in the highly interventionist context of General Franco's dictatorship (1939–1975), Urquijo became not only Spain's largest private industrial group, but a prominent associate of foreign investors, an acknowledged talent pool, and an organisational innovator.[24] Foreign capital and technology certainly fueled the group's expansion and contributed to the enhancement of local personnel's know-how and expertise in industries such as chemicals and pharmaceuticals, as suggested by the business groups literature.[25] This extraordinary development was possible due to a long-term strategic alliance with Banco Hispano-Americano, Spain's largest commercial bank and therefore a prominent source of capital, contacts and expertise, and Urquijo's organisational innovations. Regarding the latter, the technical and economic research departments (TERDs) stand out.[26]

The beginnings of the bank's TERDs date back to a broad reorganisation, implemented right after the Spanish war, aimed at ensuring generational transition, coordinating the bank and the board of directors with the participating firms, and seizing business opportunities in a particularly adverse context – Franco's nationalistic economic policy and World War II. Actually, the Urquijo Group did not exist as a formal entity until 1960, when the Bank

established an industrial division (headed by a member of the Urquijo family, Ignacio) and a financial division (headed by one of Lladó's sons, Juan). So for a long time what we and Urquijo's contemporaries call 'group' was nothing but the sum of the companies being financed, controlled or participated by the Bank, and linked through the TERDs, as shown in Figure 1. The aim was precisely to improve the flow of information and controlling power of the Bank over these companies at a time of fast growth and multiple business opportunities.

The TERDs were an essentially personal structure: the professionals that Lladó considered worthy or useful were hired, even if there was no need for them, and were encouraged to look for opportunities using the Bank as both platform and a safe partner for future business ventures. So the TERDs ended as a set of professionals that were either top executives of the firms controlled by the bank or independent professionals (mainly engineers and economists, many of them with governmental experience) expected to put their knowledge, contacts, and entrepreneurial capabilities at the service of the bank on a full-time or part-time basis. The TERDs integrated, furthermore, knowledgeable people of several generations, often linked by ties of kinship, friendship, and affinities, who were well placed in the most important regions and branches of the Spanish economy[27] They ultimately had a disproportionate, yet not always visible, influence on Spain's international economic affairs, which proved to be very useful in maintaining or strengthening Urquijo's ability to collaborate with foreign multinationals in an overall adverse and uncertain context. Such influence materialised, most notably, in the first foreign credit for the Spanish Government through the American Export-Import Bank, the nationalisation of German industrial assets, US and German economic and technical assistance programs, and cooperation agreements with French and German banks. Salaries were, furthermore, relatively high and everyone enjoyed great freedom. For external

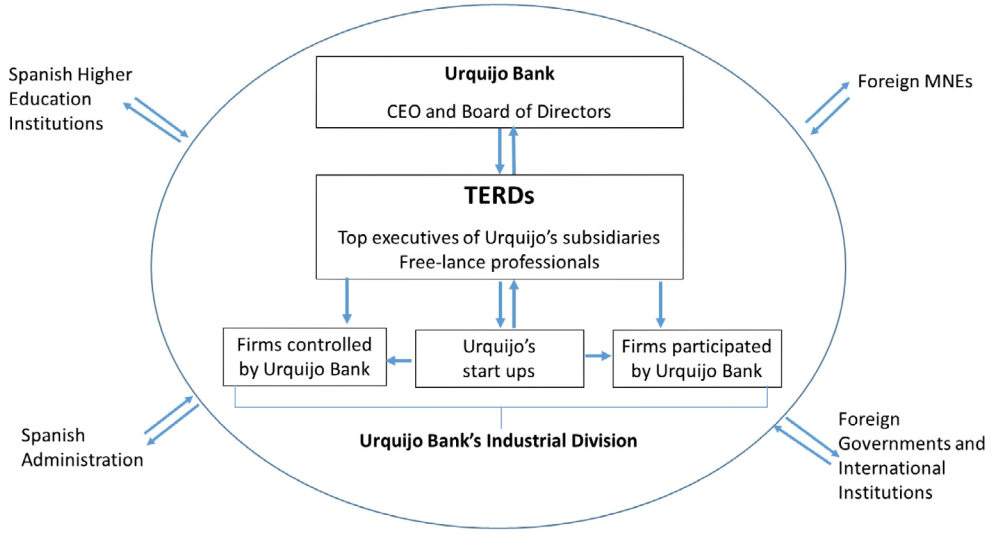

Figure 1. The context of Urquijo's Technical and Economic Research Departments. Source: Authors' own elaboration.

Note: Arrows refer to flows of knowledge and people, but also supervision and reporting flows within the group. We have tried to simplify reality to have a better idea of the central role of TERDs in the Urquijo Group. However, in such a personalist and informal organization that was the Urquijo Group at that time, flows of information and people were reciprocal among the group's units.

observers and competitors, not surprisingly TERDs constituted an excellent pool of human capital and Urquijo's greatest asset.

The technical departments were organised as industrial units, one for each of the industrial sectors where Urquijo's firms operated, with electricity, chemicals and iron and steel standing out. Their main task was to provide technical advice as well as to study new business possibilities. At the head of each unit stood an engineer with experience in the management of the Bank's companies, and most of its members became directors of the existing or newly created firms. In contrast, the mission of the research department was to control Urquijo's companies and to monitor competing companies. The Bank's ability to recruit prestigious economists earned this department a high reputation. We estimate that the number of individuals linked to the TERDs ranged from 100 to 200. Until 1960, the TERDs had no headquarters of their own. Corporate executives continued to work from their offices and walk to the bank's main office to hold regular meetings with Lladó and other board members and directors. As for the external professionals, some of them were granted space in the bank's corporate building, but others chose or were asked to work from outside. However, from 1960, the most promising technical units and spin-offs (such as Técnicas Reunidas) tended to move to a brand new building, shared with other Urquijo's participating firms.

The group, therefore, became a very flexible and personal organisation based on the capabilities of their individual members and aimed to put these at the service of the Bank's industrial expansion in a context of increasing environmental uncertainty but also of new business opportunities. Closely supervised by the Bank's Board of Directors, TERDs linked the Bank with its growing industrial group (organised around the Urquijo Bank's Industrial Division after 1960) and external institutions and business opportunities, acting as broker, auditor, consultant, and firm incubator. Like many organisations, Urquijo's technical and research departments imported many elements from their economic, political, and cultural environment yet also contributed to shape this environment, in the direction favored by Lladó and his team: a free market economy where Urquijo could make the most out of its accumulated talents and advantages, usually in collaboration with the world's large multinationals.

The case of Estudios y Proyectos Técnicos Industriales S.A. (EPTISA), the basis for the foundation of Urqujio's engineering consulting activities, helps us understand both the genesis and dynamics of the Bank's TERDs. This firm was born in a small technical office, aiming to expand and provide assistance to Urquijo's hydroelectric plants. The reputation built by this office, coupled with the expectation created by the construction of American military bases in Spain following a 1953 bilateral agreement between Spain and the United States, led to a substantial expansion of the electrical engineering unit, as the office was known, undertaking engineering projects of all kinds. In 1956 the unit was transformed into an engineering firm, EPTISA, which would become the matrix of all other Urquijo engineering companies. EPTISA built on the experience acquired by Urquijo engineers around the military bases of Rota (navy) and Torrejón (air force).[28] As of 1968 the firm employed nearly one hundred engineers and architects and 150 technicians and administrative personnel.[29] It had participated in the design and construction of more than fifty hydroelectric power plants, five motorways, three housing projects, plus a number of infrastructure projects such as dams, thermal power plants, irrigation systems, high voltage power lines, ports and drainage works.[30]

EPTISA's growth was grounded on four pillars. First, a close cooperation with the Madrid School of Civil Engineering, an effective talent pool monitored by one of its professors and EPTISA's president, Enrique Becerril.[31] Second, an early internationalisation process that

responded to the increasing competition in the domestic market and supported by the Spanish government.[32] Since the late 1950s Spain's developmental policy encouraged the creation of strategic alliances between domestic firms, which allowed EPTISA to get enough technical and economic resources to try to compete abroad. Third, EPTISA and Urquijo's TERDs joined efforts to improve the education and skills of their engineers. Finally, there was a constant search for foreign technological partners to face competitively the great expansion of hydraulic and transportation infrastructures of Spain in the 1960s.[33]

EPTISA served as the basis of Urquijo's expansion in the engineering consultancy sector. With six legally independent companies (Table 1), in the late 1960s engineering had become a star area within the Group, because of its high level of human capital, its financial performance, and its early internationalisation.[34] In 1968 their personnel were comprised of 418 doctors and engineers and 41 economists.[35]

Next, we will focus on Urquijo's two surviving engineering firms: Tecnatom and Técnicas Reunidas. Note that both were EPTISA's creatures, a fact that determined their choice of international partners: Westinghouse, a supplier of equipment and technical assistance to Tecnatom, and The Lummus Company, the strategic ally of Lummus Española – Técnicas Reunidas' forerunner. As we will see in the next section, the Spanish partners developed from the start a *learning strategy* that benefited greatly from both the dynamics of Urquijo's TERDs and their own exposure to the American companies at a very early stage. Spain's Golden Age, the 1960s, created the ideal scenario for Tecnatom and Técnicas Reunidas. Under strong international pressure, the Spanish government now promoted industrialisation through cooperation between the state-owned holding INI, domestic private companies, and foreign multinationals. Urquijo's skills were badly needed and the research departments and their offspring capitalised on this. Likewise, one should not underestimate the role played by Madrid's scientific and academic environment in this process of strengthening the technical and management capacities of the two engineering firms.

4. Case study 1: Tecnatom (1957–1974)[36]

Although the rise of nuclear energy constitutes one of the most exciting chapters of the Golden Age, it has been largely ignored or understudied from an economic and business

Table 1. Urquijo's engineering firms.

Company	Founded	Main shareholders	Industry	Main foreign partners
EPTISA	1956	Urquijo	Civil	BR&W, US Navy
EPESA	1956	Urquijo Benjumea	Civil	Westinghouse
Tecnatom	1957	Urquijo	Nuclear	Westinghouse, General Electric, Gibbs&Hill, Bechtel
Técnicas Reunidas	1960	Urquijo Banco de Bilbao (25%)	Petrochemicals	Lummus/UOP
Sidetécnica	1963	Urquijo	Iron and Steel	Krupp
Espindesa	1969	Urquijo Río Tinto	Fertilizers	None
Empresarios Agrupados	1971	Urquijo Gibbs & Hill	Nuclear	Gibbs & Hill

Source: Banco Urquijo Archive, Banco Urquijo, Annual Report, 1968; Banco Urquijo, '*El Banco Urquijo*'; Archivo Histórico BBVA, Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275; ASEINCO, '*Catálogo*', 72; and corporate annual reports.

perspective.[37] As in other areas Spain's position was ambiguous: Franco's dictatorship prevented Spanish companies from collaborating openly with Western countries, but there was wide awareness of the unique opportunities offered by the process of technological convergence that characterised the Postwar period. In 1948, the Spanish government created the Atomic Research Board (JIA), transformed in 1951 into the Nuclear Energy Board (JEN), to facilitate the dissemination of atomic energy and the cooperation between official initiatives and private companies in the nuclear field.[38]

The most important private initiative came from Urquijo Group. Advised by EPTISA engineers, who were aware of both the relevance and lack of awareness of nuclear energy in Spain, the directors of the Bank commissioned the industrial engineer Jaime Mac-Veigh (c.1900–1985), who spoke English and was familiar with the US, to gather information, explore the potential of nuclear power, and identify the most suitable partnerships. Based on Mac-Veigh's research, in 1957 the TERDs decided to establish an independent company, Tecnatom, participating by twelve companies of the Urquijo Group, most of them connected to the electricity sector.[39] Tecnatom was to revolve around Mac-Veigh's office and he was appointed CEO. He started with a staff of seven engineers and one economist, who were occasionally assisted by experts from other companies in the Group.[40]

Mac-Veigh was clear from the outset that the company was to deal with nuclear energy in the broadest sense, which meant not just solving technical problems, but gathering information and establishing contacts abroad, studying the feasibility of a nuclear plant in Spain and creating a favorable opinion within the power industry and the Spanish Administration, e.g. promoting initiatives such as hosting the World Energy Conference in Madrid in 1960. To train Tecnatom's personnel, a specialised library was set up, visits to the most advanced nuclear centres in the United States and Europe were arranged, and assistance was given to international scientific meetings such as those organised by the United Nations on the peaceful uses of atomic energy. Tecnatom worked with Urquijo's TERDs to disseminate all this new knowledge among its shareholders as well as in the academic sphere. This task was facilitated by the fact that several professors from the Madrid engineering schools, most notably Emilio Fustel and Antonio Osuna, were among Tecnatom staff.

In 1959–1960, under the auspices of the Spanish nuclear power agency JEN, Tecnatom developed a prototype nuclear plant. Atomics International, Westinghouse, and General Electric, the companies most involved in the US promotion of nuclear energy, provided technological support. This allowed a number of Tecnatom engineers to be trained in Pittsburgh and San Jose. Collaboration with the public agency was essential in the areas of staff training, in-service maintenance, and as an advisory body in the initial management of PWR and BWR simulators in nuclear power reactors that were installed at Tecnatom and used to train nuclear plant operating personnel. Also with the JEN, Tecnatom offered courses in Nuclear Engineering and Reactor Physics for the young technicians who entered the company in the 1960s and early 1970s.

By then, Mac-Veigh's company had become a reference centre that provided information and contacts with the elite of the international nuclear industry, thanks to a large extent to Mac-Veigh's social skills and Urquijo's support but also because of the lack of competitors. Tecnatom's main challenge – to show that nuclear energy was competitive – was met in 1964, when it started to design the first nuclear plant in Spain for one of Urquijo's electric companies (Unión Eléctrica Madrileña) in Zorita, not far away from Madrid. The engineering firm had just 15 people on its staff.

Tecnatom took on the responsibility of supervising the construction and monitoring the plant in all aspects. But given the technological backwardness of the country, it was necessary to seek experienced international partners to negotiate a turnkey contract. The tasks were distributed among the Westinghouse International Electric Company and its Spanish subsidiary (general contractor and equipment supplier), Gibbs & Hill (design), Zachry International of Spain (works management), EPTISA, Entrecanales and Tavora (civil infrastructure), and Bechtel Co. (contract adviser).[41] Mac-Veigh and chief economist José M. Ondaro from Tecnatom were commissioned to obtain financial resources: a credit of 24.5 million dollars from Eximbank and 6 million dollars from Chase Manhattan under unusually favorable conditions.[42] To ensure the importation of components – a major challenge – Tecnatom resorted to Urquijo's political contacts. Ironically, the lack of knowledge and experience in the nuclear field among Spanish politicians and administrators turned out to be helpful. Finally, the transportation of essential and heavy parts from the United States posed the most spectacular challenge. All in all Tecnatom proved its versatility by taking care of tasks as diverse as the plant's facilities (electricity, water, telephone, temporary buildings), the inspection of the components (contracted with Lloyd's Register of Shipping) and the construction of on-site housing for over one hundred people. Tecnatom's experience differed from any other nuclear plant constructed at that time, where the foreign contractor, General Electric, typically controlled all these tasks.[43]

The works were started on July 6, 1965. Since the project required an expert on PWR-type power plants, Tecnatom hired Giacomo Bertolotti, who had directed the construction of an Italian plant (SELNI) for Westinghouse in Italy. This stage proved crucial to Tecnatom's learning strategy, because it provided its technical personnel with first-hand experience with the elaboration of test procedures, inspection protocols, radiological protection handbooks, emergency plans, and plant operation regulations, in addition to the many legal and regulatory affairs that nuclear plants involve. Bertolotti's idea of writing an operation manual with graphics and reasoned instructions, which served as a teaching tool and illustrated procedure for the control room, turned out to be particularly effective to build specific capabilities at Tecnatom.

The engineering firm supervised the works by managing the relations between Westinghouse and the Spanish team. As there was no prior experience, Tecnatom helped establish security regulations and criteria with the JEN security department, hire personnel (reactor operators, shift leaders, and management team) and arrange their training in the United States and on the spot while the plant was being built. Although Zorita was built in a relatively short period of time, three years, it was not authorised to start up until the end of 1968. The plant (7500 MW) has been operating from 1969 through 2006.

Zorita focused the activity of Tecnatom for ten years (1960–1970). The experience and expertise acquired around this plant would determine Tecnatom's expansion and internationalisation. The nuclear plant was already working, but Tecnatom needed to specialise, finding a niche in the rising – and highly internationalised – nuclear power market. Building on Zorita's experience, Tecnatom became essentially a consulting firm that developed training courses at its facilities, worked with foreign suppliers, and provided consultancy services to the owners of future plants. The first foreign contracts were signed in 1970 in Krsko (Slovenia) and Atucha (Argentina). They were followed by others in Argentina and Mexico.

1974 marked a turning point, as Urquijo transferred its stake to the other owners (Spain's major power companies) and the post-MacVeigh leading team implemented a strategy of

fast growth, technological independence, and internationalisation. Tecnatom specialised in training and inspection tasks for nuclear plants. This specialisation was the basis of its success. Training had been expensive because it had required sending engineers and operation technicians to Westinghouse and General Electric training centres. As for inspection, it is crucial to the continuity of nuclear power plants. At first it was provided by specialised foreign companies, and thus caused important delays. Identifying an opportunity, Tecnatom prepared itself by designing a nuclear inspection plan from scratch, acquiring the appropriate technology in the international market, learning to use it, adapting it to the Spanish market, and implementing in to the plants that were being built in Spain. It was an expensive investment, but it made Tecnatom the only company with global inspection capacity. In the late 1980s, Urquijo's nuclear engineering firm had become the second largest exporter of engineering consulting services of Spain and the number of direct employees (most of them engineers) had risen from 17 in 1970 to 140 in 1980 and 450 in 1986.

5. Case study 2: Técnicas Reunidas (1960–1982)[44]

In the early 1960s Spain's new technocratic government was pushing the country's industrialisation, encouraging partnerships between foreign and Spanish, and public and private firms. One of the industries with the greatest potential growth was chemicals, in which Urquijo had a strong position due to its early involvement in the sector and to the acquisition of most of the German subsidiaries expropriated after the war.[45] The technical department was indeed well aware of the future of petrochemicals in Spain's emerging economy, as well as José Lladó, the very capable son of Juan Lladó, Urquijo's CEO, and one of the first to promote consulting engineering in this field.

While completing his PhD in Chemistry at the University of Madrid, in close cooperation with many Urquijo's associates with great expertise in the industry,[46] José Lladó worked part-time in EPTISA, as aforementioned the oldest consulting firm of the group. In EPTISA Lladó met Javier Benjumea, the local partner of many US chemical companies in Spain (such as 3M and Gulf) and the first to envisage how an alliance with Lummus could expand Urquijo's activities in consulting services for petrochemical plants. In particular, Benjumea offered Lladó to supervise the construction of a fertilizer plant with the technical assistance of Lummus and the economic support of the Eximbank.[47] Convinced of the future expansion of his field of expertise, Lladó not only accepted, but also supported the foundation of Lummus Española (LESA) in 1960, as a joint venture between the American consulting firm and Urquijo's civil-engineering firms EPTISA and EPESA.

LESA's first contract was a fertilizer plant for Abonos Sevilla, one of Urquijo's participating firms. Interestingly, the project relied on the technical advice of Antonio Osuna (EPTISA) and a small number of professionals that with Lladó Jr. would constitute the hard core of LESA first and then Técnicas Reunidas.[48] After the fertilizer plant came a vinyl chloride plant for Monsanto, a polystyrene plant for Dow Unquinesa, and a polyethylene plant for Calatrava – a joint venture between the public holding INI and the American company Phillips Petroleum. In order to tackle these pioneering projects, LESA continued to rely on EPTISA-Urquijo's human capital and Lummus know-how.[49] It is noteworthy that at that time INI established its own consulting firm, INITEC, which would end up being acquired by Técnicas Reunidas in 2000. As some of the main characters of this story remember, LESA's Spanish LESA learned much from their powerful international clients. Also from Lummus, whose

main contribution, according to Jesús Bécares, was its managerial knowhow.[50] This was the weak point for Spanish engineers, otherwise highly valued by foreign firms. Thus Lummus provided not so much the scientific knowledge, which was available in Spain, but the technical and organisational experience needed to undertake the ambitious projects of its Spanish joint-venture. In retrospect, the contract that would determine LESA's or more precisely Técnicas' future specialisation in process engineering and turnkey projects was the construction of an oil refinery in La Coruña (Northwest Spain) for Petroliber in 1963. By that time, Lummus Española knew very well the Spanish suppliers of capital goods, a fact that allowed the joint-venture to compete successfully with international competitors.

LESA's Spanish engineers soon realised that they wanted to go beyond process engineering, which was Lummus' expertise.[51] Project management and turnkey projects were more complex from a technical, economic, and organisational perspective, but also much more profitable. The opportunity to make this important transition appeared in 1968, when LESA accepted a project to build an oil refinery in Luján de Cuyo (Argentina) for Yacimientos Petrolíferos Fiscales (YPF): its first turnkey project abroad. As in the case of Tecnatom and the construction of the first nuclear plant in Spain, here the client was looking for an already well-know and large company to act as general contractor.[52] And this was Lummus. Other companies that got involved in the Argentinian project were UOP (basic engineering) and Mellor Goodwin (process engineering), a local company already working with Lummus licenses.[53] Detailed engineering, procurement, and the supervision of civil works was carried out by LESA in close cooperation with Lummus. The American company also trained the Spanish engineers in Spain and the US.

Spain's nationalistic economic policy, however, did not allow foreign companies to participate in strategic projects such as oil refineries or fertilizer plants. This prompted Urquijo-EPTISA to establish an independent firm, Técnicas Reunidas, in 1965. For such a risky and expensive enterprise, the Bank worked hard to involve Banco de Bilbao, a large Spanish universal bank.[54] The idea, consistent with the Group's learning strategy, was that the new firm collaborated with LESA to launch new projects. It turned out to be an excellent strategy, for Técnicas' first large project, a refining plant for Esso, had been originally granted to Lummus. However, a combination of political pressure and knowledge of the domestic market worked in favor of the replacement.

In 1971, Urquijo-EPTISA established Empresarios Agrupados, a strategic alliance between Técnicas Reunidas, Gibbs & Hill Española (GHESA), and EPTISA aimed at improving the competitiveness of Spanish engineering firms.[55] Again, Técnicas' leading team was persuaded that the only way to build capabilities was through the challenges and experience of working on important projects. Empresarios Agrupados did actually help Técnicas Reunidas enter new petrochemical areas and expose itself to the superior knowledge and expertise of its international partners. Expectations for Técnicas were bright, but for how long could LESA and the new firm coexist? As early as 1972, a conflict of interest arose because of Técnicas' participation in a nuclear energy project.[56] Lummus, which had been recently acquired by Combustion Engineering, argued that this was incompatible with the strategic goals of the American group and offered to sell its stake in Lummus Española, which would be absorbed by Técnicas Reunidas. By then it had become obvious that Lummus preferred to stay in its core business, process and basic engineering, rather than to enter the more complex and financially demanding area of turnkey projects, the target of the Spanish directors of LESA and Técnicas Reunidas. It was a risky move, but Lladó trusted his strong and seasoned team

of professionals, the accumulated experience with more advanced partners, and last but not least the support of both Urquijo Group and the Spanish Administration. Each of these assets deserves close examination.

Human capital is the most important single asset in engineering consultancy. The human team trained at LESA (initially a very small, all-Spanish group of people plus one American director that chose to stay) formed the core of Técnicas Reunidas. Characterised by a strikingly low rotation rate, Técnicas' personnel had evolved to about 400 employees, 250 of them local university graduates, in 1968 and to more than 1,000 in 1972–73.[57] This figure has remained quite stable until the turn of the century, when through the acquisition of INITEC and others the number of permanent employees reached 4,000. Although Técnicas Reunidas has become a global firm, the headquarters remain in Madrid, and although the human team is remarkably multinational, the firm keeps strong links to its historical constituency of higher education institutions, most of them based in Madrid.

According to José Lladó and to a 2010 internal report, the establishment of a department of process engineering was crucial to develop the capabilities that Spanish engineering firms lacked in the 1960s and to compete successfully in the domestic market.[58] The Spanish engineers were proud of their sound scientific and technical education but also aware of their lack of managerial training and experience, which was precisely the strength of Lummus and the many American partners and instructors they had been exposed to since 1960. They felt that they had to learn fast. As Jesús Bécares, Human Resource Manager in Técnicas Reunidas, observes, they also needed to overcome the highly personalist and unstructured style of the Urquijo Group in order to generate in-house project directors. Over time, Técnicas has indeed become a 'school of project directors', an achievement that involved a massive learning and standardisation effort.[59] As in the case of Tecnatom, the instruction manuals produced within LESA and Técnicas turned out to be a fundamental tool.

One of the classical statements of the business group literature is that business groups are often active players in their economic environments, eventually participating in the design of the rules of the game. This applies to Urquijo and its most conspicuous firms. Although petrochemicals were not as controversial as nuclear power, they also needed a favorable public opinion and, above all, investors who believed in the future of oil against coal. In 1962, a young José Lladó who was still working on his doctoral dissertation, published a book on the subject.[60] Six years later, he started a remarkable public service career that took him to hold public office (as director general of chemical industries and ambassador to Washington, among other) from 1964 to 1982. None of this would prevent Lladó from continuing to exercise the de facto presidency of Técnicas Reunidas and increasing his personal share in the firm's capital. It is also noteworthy that José married a daughter of Manuel Arburúa and Miyar, Minister of Commerce with Franco and president of the Banco Exterior de España and the Foreign Bank of Spain and the Banco Mercantil e Industrial: all of them institutions vital for the international growth of Técnicas Reunidas. This experienced a turning point in 1981, as the engineering firm accepted its first turnkey construction project in Dumai (Indonesia). Lladó's return from Washington coincided with the Bank's collapse and the dismantling of the remains of its industrial group.[61] It seems reasonable to think that by then Técnicas no longer needed the group. It was already a fairly independent firm with strong partners (the Lladó family and Banco de Bilbao), a highly qualified human team and proven technological, project execution, and political capabilities. Moreover, its project portfolio was increasingly international, as it successfully competed for new turnkey projects in other parts of the world.[62]

6. Conclusions

How does inward FDI affect entrepreneurial and managerial talent in host economies? To approach this fascinating issue, we have shifted the focus from the MNE to the host economy, its main business actors and institutional environment. We have gone beyond the traditional industries, looking into a knowledge-intensive industry, engineering consulting, in which local human capital plays a vital role. And we have applied historical methods, searching for new empirical evidence, long term developments and complex, dynamic processes, through a case-study analysis of Tecnatom and Técnicas Reunidas, both pioneering and leading firms grounded upon the technical and research departments of the largest private business group of 20th-century Spain, Urquijo.

Our research reveals, first, that the flexible and rather personal organisational structure of Urquijo Group was crucial for partnering with international firms, recruiting and training local human capital, and developing business projects. The group's technical and research departments (TERDs) played a key role in these processes. Closely supervised by Urquijo's Board of Directors, TERDs link the bank with its growing industrial group and outside institutions and business opportunities, fueling flows of knowledge and people, encouraging fast learning as a result, and acting as broker, auditor, consultant, and company incubator. Whereas Urquijo's reputation was a magnet for both foreign companies and Spanish professionals, its awareness made it a pioneer in the most promising fields. It is reasonable to think that the comparatively good performance of the new ventures created tensions with traditional firms within the group, many of which found themselves unable to compete in the post-1960s scenario, but this is beyond the scope of this article.

Second, American firms seemed willing to share their knowledge with their Spanish partners. The overall positive international environment of the golden age and the dynamics and relative youth of engineering consulting might be a reason. Firms operating in new, knowledge intensive industries tend to behave differently than those in traditional, more mature environments. But the stories of Tecnatom and Técnicas Reunidas suggest that capable and pro-active local firms can get the most out of international partnerships, eventually using natural or institutional advantages in their favor. This has been observed for other engineering consulting firms, not belonging to a business group, which established strategic alliances with foreign partners.[63] It is also consistent with recent research on the effects of FDI in contemporary Spain and confirms those works that, for manufacturing industries and based on aggregate data, suggest that some internalisation of foreign knowledge took place during the Spanish economic miracle.[64] Our research also highlights the role played by human capital in the increase of total factor productivity during the European Golden Age.[65] It furthermore provides evidence of how foreign technology was incorporated via direct investment. Obviously, differences might exist across industries and the learning strategies observed in some sectors were not enough to allow the Spanish economy as a whole to turn into a net innovative country.[66]

Third, our research shows that both Tecnatom and Técnicas developed learning strategies from the onset. Learning was not limited to the technical and managerial knowhow of their foreign partners, but also to the knowhow of their international clients and domestic suppliers. The capabilities created at the two Spanish engineering firms were grounded on their ability to absorb all that external knowledge to adapt it later to the specific needs and opportunities offered by Spanish and then foreign markets. In contrast to most of the existing literature, we show that Spanish engineering consultancy was often not as structurally

dependent from foreign knowledge as suggested by data on licensing and technical-assistance agreements.[67] In fact, such agreements would have triggered a learning process. We have to take into account, furthermore, that engineering consulting firms engaged in technlogy from other project management contractors (via licenses for instance) as a result of the very nature of the service provided (design and supervision of all the tasks involved), not because of a lack of innovation capacity (as in the case of manufacturing firms). We also integrate the business group's dynamics into the explanation for Spanish engineering firms' global competitiveness, a variable not taken into account in previous studies which have analyzed how Spanish engineering consulting firms learnt from their foreign headquarters or partners.[68] The Urquijo Group was in a privileged position to scan the group's external environment. In addition, it enhanced effective internal and external communication through a very flexible organisation structure, while developing a culture of innovation. And external scanning and internalisation of external knowledge are in the core of the absorptive capacity theory.[69] Furthermore, and contrary to what has been observed in Spanish manufacturing firms by management scholars, we observed that the enablement of local human capital, internal organisation of innovation and external collaboration (universities, suppliers and clients, among other) contributes to firm's capacity to absorb new knowledge.[70] It is true, though, that the nature of modern engineering consulting (customised service usually in form of project management and turnkey project) may help in this absorbing process. But It is less clear to us how the entry mode of the MNEs (technical agreement vs. joint-venture) affected the exploration, assimilation, and exploitation of this new knowledge.

Fourth, timing matters. The cases of Tecnatom and Técnicas suggest that the early exposure of young, hence more open and absorptive local firms to technologically advanced companies facilitate learning. New knowledge became embodied in the human team and sustained growth at home and abroad.

Fifth, institutions also matter. As stated above, the postwar international environment fostered technological exchange and convergence. To a large extent, engineering consulting was a child of this new environment. At the host country level, Spain's new developmental policy encouraged technological transfer – eventually appropriation – through cooperation between MNEs and local firms (at least if the former wanted to take advantage of public subsidies and public tenders). Local higher education institutions, particularly those in the Madrid area, also played a relevant role in the construction of Tecnatom and Técnicas.

Finally, it seems legitimate to ask whether the impact of MNEs such as Westinghouse and Lummus had been comparable with a less proactive partner than Urquijo. Likewise, we might ask whether the learning strategies that transformed Tecnatom and Técnicas Reunidas into leading independent companies had been developed under the umbrella of a business group more focused on defending the interests of the MNEs than shaping the rules and benefiting from Spain's developmental program. Unfortunately, the study of the other large business group in the sector (the state-holding Instituto Nacional de Industria) still remains undone. In any case, the list of counterfactuals could be very long.

Our study, to conclude, shows how studying engineering consulting, a still under-researched industry, is ideal for examining the complex, polyhedral process through which MNEs impact the host economies where they operate. The enablement of local human capital depends to a large extent on locals' learning strategies, which, as our cases reveal, depend much more on local actors and environment than on foreign MNEs. They also show that the earlier the exposure to MNEs, then the lighter the burden of procedures and bureaucracy,

and the greater the learning and spillovers. But knowledge transfer across and within borders is a long-lasting process, with many multiplying and indirect effects. Research using historical methods and perspective proves, therefore, to be of great interest to shed new light on how foreign investment might encourage the creation of capabilities in host economies.

Notes

1. Literature on the role played by foreign capital and local business groups in Spain's modernisation is abundant. See, for instance, Muñoz, Roldán and Serrano, *La internacionalización;* Valdaliso, 'Grupos empresariales'; San Román 'Un zaibatsu'; and Fernández and Díaz, 'Entre el poder'. A recent overview on FDI and the growth of the Spanish economy, in Puig and Álvaro-Moya 'The long-term impact'.
2. Jones, 'Editor's Introduction'; Jones 'Firms and Global Capitalism,' 191; Wilkins, 'Multinational Enterprises'; Lall and Narula, 'Foreign Direct Investment'; Narula and Dunning, 'Multinational Enterprises'; Narula and Driffield, 'Does FDI cause development?', and Narula 'Foreign Direct investment as a driver'.
3. Jones 'Firms and Global Capitalism'.
4. Guillén, 'Business Groups in Emerging Economies'; Barbero and Puig, 'Business Groups around the world'; Colpan, Hikino and Lincoln, *The Oxford Handbook*, and Colpan and Hikino, 'Diversified Business Groups'.
5. Business groups' ability to deal with governments and foreign investors has also been highly criticised by scholarship. Since Leff's ('Industrial Organization') and Strachan's ('Family and Other Business Groups') seminal works, scholarship has paid an increasing attention to the study of business groups in the last 20 years. For updated overviews from a business history perspective, see Barbero and Puig, 'Business Groups around the world'; and Colpan, Hikino and Lincoln, *The Oxford Handbook*, and Colpan and Hikino, 'Diversified Business Groups'.
6. Amsdem and Hikino, 'Project Execution Capability,' Kock and Guillén, 'Strategy and Structure,' and Guillén, 'Business Groups in Emerging Economies.'
7. Guillén, *The Rise of Spanish Multinationals*; and Guillén and García-Canal, *The New Multinationals.*
8. See Empson *et al.* 'Researching', for a definition of service professional firms and the problems that arise when trying to define them.
9. Sánchez-Sellero *et al*. 'Absorptive capacity'. These authors, however, find that for Spanish manufacturing firms in the 1990s only product differentiation has a significant and positive effect on firms' absorptive capacity.
10. Arora and Gambardella, 'Evolution of Industry Structure'; Arora and Rosenberg, 'Chemicals'; van Rooij and Homburg, *Building the Plant;* and van Rooij, *Building plants.*
11. From a business history perspective, see the works cited in note 9. Also, Dienel's research on the company Linde (Dienel, *Linde)*. International business scholarship has often focused on the idiosyncrasy of professional service firms (not specifically of engineering consulting), rather on their potential to disseminate knowledge. See Feketekuty, 'Trade in Professional Services'; Aharoni, 'Globalization of Professionals'; Krull, Smith and Ge, 'The internationalization'; Løwendahl, *Strategic Management*; Empson *et al., Oxford Handbook*.
12. Moran, **'**How Does FDI'; Narula and Driffield 'Does FDI cause development?'; Narula, 'Foreign Direct Investment as a driver'.
13. Cebrián, 'Las fuentes'; Sanchís 'The Spanish economic miracle'; Sanchís *et al.* 'Total factor productivity'. In particular, total factor productivity contribution to Spain's growth in the period 1960–1973 was 65.3% (around 50% for countries such as Britain and Germany), while capital 31% (around 50% in the other countries) and labor 3%. Cebrián, 'Las fuentes', 287.
14. Hidalgo *et al*. 'Technology and industrialisation'. These authors found for that period, on one hand, an increase of work productivity (that is, of potential knowledge dissemination) and, on the other, that those sectors of fastest growth reduced their dependence from imported machinery (that is, they were able to internalise foreign knowledge). This corroborates recent research on the issue from a business history perspective (an overview in Puig and Álvaro-Moya 'The long-term impact'). Spillovers from FDI in Spain's manufacturing sector in the 1990s and

2000s has also been tested by Sánchez-Sellero *et al.* 'Absorptive capacity', Barrios et al. 'Efficiency Spillovers' and Álvarez and Molero 'Technology and the generation'. The Spanish patent system, furthermore, was designed to provide protection to innovators while encouraging fast growth through the limitation of that protection if it did not turn into innovation. See Sáiz 'Did patents of introduction encourage'. And the liberalisation, albeit still rather timid, inaugurated with the Stabilisation Plan of 1959, encouraged manufacturing firms, even in mature sectors such as the cotton industry, to assume higher levels of commercial and financial risk, as well as to modernise their factories and professionalise their management. See Fernández Roca 'The adaptative'.

15. Álvaro-Moya, 'Los inicios', 107.
16. Feketekuty, 'Trade in Professional Services'; Aharoni, 'Globalization of Professional'; Løwendahl, *Strategic Management*.
17. Aharoni, 'Globalization of Professional,' and Løwendahl, *Strategic Management*.
18. Linder, *Projecting Capitalism*; Hartley, *Consulting Engineering*; Jones, *Multinationals*, 119.
19. Van Rooij and Homburg, *Building the Plant;* Van Rooij, *Building Plants;* Dienel, *Linde*.
20. Aharoni, 'Globalization of Professional,' 7–10.
21. Álvaro-Moya 'The globalization'.
22. Masía, 'El licenciamiento'; Reus, 'Análisis de las actividades', 3–4; Egurbide, 'El "consulting"', 136; Molero, 'Las empresas de ingeniería.'
23. Puig and Torres, 'Grupos empresariales,' and Puig and Torres, *La crisis de un gran banco*.
24. Puig and Torres, 'Grupos empresariales'.
25. See note 6. About Urquijo's activities in chemicals and pharmaceuticals, see Puig, *Bayer*.
26. Only the Bank of Spain had a proper research department, created in 1930 after the Paribas model. A few years earlier, the Catalan financier and politician Francesc Cambó also established a research unit within the electrical company CHADE, associated with the German multinational AEG. Puig, Santisteban and Torres, *Juan Lladó*.
27. The first research commission included at least thirteen reputed experts in the following sectors: infrastructures, concrete, mining and steel, ship building, chemicals, pharmaceuticals, fertilizers, metals, electric power, railways, finance, and labor issues. Puig and Torres, *Banco Urquijo*, 107–108.
28. Banco Urquijo, *El Banco Urquijo*, 35. According to Julio Hernández Rubio (interviewed 9 November 2010), the construction of the US military bases, closely supervised by American military engineers, provided a unique opportunity to Spanish engineers like himself because of the complexity of the projects and their close cooperation with the US Navy and American engineers. See also Puig and Torres, *Banco Urquijo,* 194.
29. Fondo Banco Urquijo (FBU hereafter), EPTISA, Annual Report, 1968.
30. Banco Urquijo, *El Banco Urquijo*, 36; FBU, EPTISA, Annual Reports, 1956–1968.
31. This school, currently integrated into the Universidad Politécnica de Madrid, was founded in the early nineteenth century to train civil engineers working for the government.
32. FBU, EPTISA, Annual Reports, 1956 and 1960.
33. FBU, EPTISA, Annual Reports, 1956–1970; Banco Urquijo, *El Banco Urquijo.*
34. Banco Urquijo Archive (BUA hereafter), General Meeting of Shareholders, 2 March 1968; Banco Urquijo, *El Banco Urquijo*, 36.
35. BUA, Banco Urquijo, Annual Report, 1968.
36. This section is based on the following sources: BUA, Minutes of the Shareholders Meetings; Archivo Histórico BBVA (AHBBVA hereafter), Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275; Banco Urquijo, El Banco Urquijo; and Tecnatom, Tecnatom.
37. De la Torre and Rubio-Varas, 'Nuclear Power for a Dictatorship'; De la Torre and Rubio-Varas 'La financiación'.
38. Since 1986 Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), dependent on the Economic Ministry,.
39. See the Company history, Tecnatom, *Tecnatom*.
40. Alejandro Bueno, José Ignacio Cabrera, Gustavo Giménez Ramos, Emilio Fustel, Antonio Osuna, Rosa M. Meléndez, Eduardo Sánchez Serrano and the economist José M. Ondaro. Tecnatom, *Tecnatom,* 36–39.

41. De la Torre and Rubio-Varas 'La financiación,' 117.
42. De la Torre and Rubio-Varas, 'La financiación,' 114–118.
43. We refer to Garoña nuclear plant. De la Torre and Rubio-Varas, 'New exports'.
44. This section is based on the following sources: Banco Urquijo, El Banco Urquijo, 34–38; BUA, Técnicas Reunidas, José Lladó's address to the annual general meeting of shareholders of (23 June 2010); FBU, Annual Reports of LESA and Técnicas Reunidas; AHBBVA, Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275; Archivo General de la Administración (AGA, hereafter), (13)104 71/5190, files 794-E-1/2 and 4; AGA (13) 104 71/5181, File 655; and personal interviews with José and Juan Lladó Fernández-Urrutia (28 June 2010 and 18 January 2011, and 8 January 2011, respectively) and Jesús Bécares, Human Resources Manager in Técnicas Reunidas (15 July 2016).
45. Puig, *La industria química*; and Puig and Álvaro, 'Misión imposible'.
46. Such as Hernández Rubio, Luis Solana, Antonio Gallego and Leopoldo Calvo-Sotelo, among others. Interviews to José and Juan Lladó Fernández-Urrutia (28 June 2010, and 8 and 18 January 2011) and Puig, Santisteban and Torres, *Juan Lladó.*
47. The most important projects include: Esso-Castellón, Petroliber-Coruña, Repesa-Escombreras, Industrias Químicas Asociadas-Tarragona, Abonos Sevilla and Abonos Complejos del Sureste. AGA (13)1.04 71/5190, files 794-E-1/2 and 4; AGA (13)1.04 71/5217, file 958-Q; and FBU, LESA, Annual Reports, 1960–1972.
48. The engineers Álvaro Badiola, Álvaro García-Agulló and Eduardo Araoz. Interview to José Lladó Fernández-Urrutia (28 June 2010). See also AGA (12)1.03 64/18772 on Lummus first years training in LESA.
49. AGA (13)1.04 71/5190, files 794-E-1/2 and 4.
50. Interview to Jesús Bécares, 15 July 2016.
51. BUA, Técnicas Reunidas, José Lladó's address to the annual general meeting of shareholders of (23 June 2010); and interview to Jesús Bécares, 15 July 2016.
52. AGA, (13) 1.04 71/5181, File 655; AHBBVA, Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275.
53. As listed on Mellor Goodwin's website by 15 October 2016 (http://www.mellorgoodwin.com/espana/quienes.html).
54. AHBBVA, Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275.
55. FBU, EPTISA Annual Report, 1971.
56. BUA, Técnicas Reunidas, José Lladó's address to the annual general meeting of shareholders of (23 June 2010); and AHBBVA, Fondo Banco de Bilbao, Sección Sociedad de Gestión Industrial Bancobao (BBG), Expedientes de empresas, box 275.
57. Banco Urquijo, *El Banco Urquijo,* 36.
58. Interviewed on 28 June 2010 and 18 January 2011. BUA, Técnicas Reunidas, José Lladó's address to the annual general meeting of shareholders of (23 June 2010).
59. Interview to Jesús Bécares, 15 July 2016.
60. Published by Urquijo's own publishing Company with an introduction by his PhD adviser, Lladó, *Aspectos*. See also Puig, Santisteban and Torres, *Juan Lladó*.
61. Puig and Torres, *La crisis de un gran banco.*
62. FBU, Técnicas Reunidas, Annual Reports, 1971–1980.
63. Álvaro-Moya 'The globalization'. We still have little information, however, about how those partnerships worked.
64. See notes 12 and 13. Literature on the role of foreign capital and technology in the Spanish growth is too abundant to refer to it here. A recent and updated overview in Puig and Álvaro-Moya 'The long-term impact'. See also Fernández Pérez 'Partners in a journey'.
65. Sanchís *et al.* 'Total factor productivity'.
66. López and Valdaliso 'Cambio tecnológico'; Sanchís *et al.* 'Total factor productivity'.
67. Molero, 'Las empresas de ingeniería'; Cebrián 'Las fuentes'.
68. Álvaro-Moya, 'The globalization', and De la Torre and Rubio-Varas, 'New exports'. In fact, considering TERDs functioning explains much of Mac-Veigh's vision to create Tecnatom and

its ability to quickly engage it in the Zorita nuclear plant, an aspect that intrigues the authors of the second work cited before.

69. Cohen and Levinthal 'Absorptive capacity'. See also the most recent works of Lenox and King 'Prospects for developing' and Park and Ghauri 'Key factors affecting' on the role of internal communication and external collaboration, respectively, for innovation.
70. Sánchez-Sellero *et al*. 'Absorptive capacity'.

Acknowledgments

This research has benefited from the research project ECO2012-35266 from the Spanish Ministry of Economy and Competitiveness.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Spanish Ministry of Economy and Competitiveness [grant number ECO2012-35266].

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