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# *Innovation and internationalization in KIBS and the manufacturing sector: a comparative assessment of the Basque Country and Catalonia*

The internationalization of KIBS is an opportunity to acquire new knowledge, which can, in turn, lead to the creation of innovative, highly impactful solutions for manufacturing processes. This article uses Input-Output tables to empirically explore the evolution of the demand in the knowledge intensive services sector and the expansion of KIBS to external markets 'pushed' by the manufacturing sector. The findings related to the association between KIBS exports and the intensity of activity in particular KIBS typologies, such as T-KIBS in the Basque Country, would suggest that a virtuous «*innovation-internationalization*» circle exists.

*La internacionalización de las KIBS es una oportunidad para acceder a nuevos conocimientos, los cuales a su vez pueden generar nuevas soluciones innovadoras y de impacto en la industria manufacturera. Este artículo utiliza la metodología de las Tablas Input-Output para explorar empíricamente en la evolución de la demanda de los servicios intensivos en conocimiento y la apertura de las KIBS a mercados internacionales «siguiendo» a las manufacturas. La asociación entre las exportaciones de las KIBS y la intensidad de uso de algunas tipologías de KIBS, tales como T-KIBS en el País Vasco, podrían sugerir la existencia de un círculo virtuoso «innovación-internacionalización».*

KIBSen nazioartekotzea ezagutza berrietara sarbidea izateko aukera bat da. Ezagutza horiek, aldi berean, manufaktura-industrian eragina duten irtenbide berritzaileak sor ditzakete. Artikulu honek Input-Output Taulen metodologia erabiltzen du ezagutza-zerbitzu intentsiboen eskaeraren bilakaeraren eta manufakturak «jarraitzen» nazioarteko merkatuetarako KIBSen irekieraren azterketa enpirikoa egiteko. KIBSen esportazioen arteko loturak eta Euskadiko T-KIBak bezalako KIBS mota batzuen erabilera-intentsitateak «Berrikuntza-nazioartekotze» zirkulu bertutetsu bat dagoela iradoki lezakete.

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**Keywords:** KIBS, internationalization, interlinkages, input-output.

**Palabras clave:** KIBS, internacionalización, interacción, input-output.

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## **1. INTRODUCTION**

As KIBS firms transform information and knowledge into innovative solutions tailored to the client organization's needs (Shearmur *et al.*, 2015), the growth of the KIBS sector can be seen as an indicator of regional modernization and renewal processes (Corrocher and Cusmano, 2014; Horváth and Rabetino, 2019). Hence, the presence of KIBS has been a growing interest in the literature (Muller and Zenker, 2001; Doloreux and Shearmur, 2012; Kamp and Sisti, 2018). Most geographers traditionally defend that KIBS benefit from knowledge spillovers, availability of a highly skilled labour force and closeness to their customers and, as expected, KIBS are largely agglomerated towards metropolitan cities. However, beside agglomeration economies, the intermediate demand and region-specific innovation and knowledge infrastructure are also determinants explaining the presence of KIBS (Muller and

Zenker, 2001; Koch and Stahlecker, 2006; Meliciani and Savona, 2015, Sisti and Zubiaurre, 2020). Within this trend, in addition to the importance of spatial proximity and domestic context (Miles, 2005), and against the hypothesis of distance as a barrier for knowledge spillovers (Simmie, 2003; Simmie and Strambach, 2006), the internationalization of KIBS is of undeniable importance (Rodríguez and Nieto, 2012).

The internationalization of KIBS is not a new phenomenon (Winch, 2008; Di Maria *et al.*, 2012; Shearmur *et al.*, 2015) although there remains perception that international operations of KIBS are sensitive due to regulatory, cultural or strategic elements. Moreover, the literature maintains that by expanding into new foreign markets, KIBS benefit from further knowledge that can help them manage complex projects fostering innovation (Di Maria *et al.*, 2012). The importance of the international behavior of KIBS is based on the assumption that a virtuous circle exists between the internationalization of manufacturers and the internationalization of KIBS, suggesting that the greater the knowledge flow between KIBS and the manufacturing sector, the greater the internationalization of business. This, in turn, encourages KIBS to engage in the sourcing and internalization of global knowledge, which is a key part of the innovation process. This argument reinforces the claim for the need for more research on the internationalization of KIBS (Rodríguez and Nieto, 2012; Di Maria *et al.*, 2012).

To this end, we first explored empirically whether the demand for KIBS is growing in the manufacturing sector. Secondly, we examined whether or not the increased internationalization of KIBS is viewed as a response to the push effect of the internationalization of manufacturing. And last but not least, the third research question investigated whether the positive relationship between the internationalization of manufacturing and the internationalization of KIBS is equally significant across all the KIBS categories. The empirical research settings from which we have drawn the data are the regional contexts of the Basque Country and Catalonia. These two regions are deemed valid test settings as: i) they constitute the traditional industrial heartlands of Spain, ii) they are two regions with long-standing great innovative dynamism (OECD, 2010; OECD, 2011) and iii) the availability of data. Methodology address Input-output (I-O) analysis, a useful framework for assessing linkages between KIBS and manufacturers since it allows KIBS to be studied as intermediate inputs in manufacturing. I-O tables also allow us to study the financial flows of the different sectors in an economy. The I-O tables for the Basque Country and Catalonia for the years 2001, 2005, 2011, 2014 and 2019, provided by EUSTAT (Basque Statistical Institute) and IDESCAT (Statistical Institute of Catalonia), respectively, allow us to illustrate the patterns for these two geographical areas of special interest.

This research aims to contribute to the scant empirical literature in KIBS internationalization. As an explanatory factor of internationalization, the study evaluates KIBS and manufacturing interlinkages empirically, and offers an original perspective on the supply side by distinguishing between i) T-KIBS (R&D and other techni-

cal services); ii) C-KIBS (computer and related services) and iii) P-KIBS (legal services, consultancy and market services), in keeping with NACE codes and following Böhn and Thomi (2003). We argue that greater KIBS demand from manufacturing exporters could challenge service providers to follow clients to foreign markets. A deeper understanding of how the two territories materialize internationalization can help to shed light on how to design appropriately targeted industrial and innovation policies at subnational level.

The paper is organized as follows. Section 1 offers an introduction. Section 2 presents the key theoretical elements. Section 3 defines KIBS and the data source and describes the methodology. Section 4 presents the empirical results. Section 5 discusses. Finally, section 6 presents the conclusions, limitations and suggestions for future research.

## 2. THEORETICAL APPROACH

KIBS are defined as firms that provide *«professional, scientific and technical services for the purpose of developing a customised service or product solution to satisfy the client's needs»* (Bettencourt *et al.*, 2002). The role of these firms as drivers of development (Miles, 2005) in the learning-based economy has received growing attention. Although there is some evidence that interaction between KIBS and manufacturers has fueled territorial development (Lafuente *et al.*, 2017), it remains to be seen whether competitive advantage and trade openness in the manufacturing sector translates into greater market opportunities for KIBS. With the aim of examining the performance of KIBS on the international stage, we based our theory on two pillars. Firstly, the evidence supports the idea that manufacturing competitiveness largely depends on knowledge contents which can be provided by highly specialised suppliers (Kamp and Apodaca, 2017; Braga *et al.*, 2018). Secondly, when KIBS expand internationally, they are not only following a self-driven impulse to break into foreign markets and exploit new opportunities, they are also responding to a need to follow their clients (Rose and Hinings, 1999; Miles, 2005; Huggins, 2011; Winch, 2011) which, in turn, provides a new space for the flow of knowledge.

### 2.1. KIBS as a source of knowledge for manufacturing competitiveness

It is widely accepted that the competitiveness of the advanced economies is based on the innovation capacity of the country (Orkestra, 2009; WEF, 2021). At a micro level, innovation is also broadly considered the core capability that sustains a company's entire competitive position and superior customer value (Kim and Mauborgne, 1999). There are many studies in the field of strategy and international management that confirm a positive relationship between innovation and corporate competitiveness, where competitiveness is seen as the ability to compete successfully in global markets. For example, the empirical literature on international trade has addressed the positive association between product innovation and the decision to export (Cassi-

man and Golovko, 2011). Similarly, innovation and internationalization is also a two-sided relationship at KIBS. In this respect, Di Maria *et al.* (2012) argue that «*KIBS with higher capabilities in organizing internal (and external) resources and competences oriented to innovation are also more international than the other KIBS*». There is further evidence to support the impact of internationalization on innovation through a learning by exporting process (Salomon and Shaver, 2005; Aw *et al.*, 2009; Kiriyama, 2012). The exporters often have the opportunity to access knowledge that is not available in the local market, and after a process of absorption and learning in the company, this new knowledge can be transferred to processes of greater innovation. In fact, in many studies, innovation and internationalization have been described as two basic interconnected growth strategies, each reinforcing the other, creating a mutually beneficial virtuous circle (Filipescu *et al.*, 2013; Freixanet, 2012).

Collaborations between KIBS and manufacturers have long attracted the interest of researchers and practitioners due to the symbiotic relationship which allows manufacturers to develop tailored solutions to complex problems through knowledge transformation (Strambach, 2008; Muller and Doloreux, 2007). KIBS were initially considered intermediaries in innovation processes, carrying out «bridging» or «mediating» activities related to expert consulting (Muller and Zenker, 2001). However, interactions between KIBS and manufacturing firms do not only involve the exchange of knowledge, they also contribute to the development of knowledge (Pace and Miles, 2020). Consequently, their role as necessary collaborators has gradually become recognized (Doloreux *et al.*, 2021). In this vein, Zhou and Wang (2020) also corroborated the relationship between KIBS and innovativeness in manufacturing, defining KIBS as «*mentor and director, coordinator, strategic leader and gatekeeper, sponsor, and product champion in crossing the fuzzy front end of new product development (NPD)*».

This conceptual framework assumes that firms engaged in innovation processes but lacking in internal resources and capabilities maximize their own potential by sourcing knowledge from KIBS (Ciriaci *et al.*, 2015; Seclen-Luna *et al.*, 2022; Zhou and Wang, 2020). The importance of external knowledge in innovation has been discussed widely in the literature on open innovation (Chesbrough, 2003). It is not a question of denying the importance of internal knowledge but rather of valuing the advantages of accessing readily available external knowledge which can, in turn, speed up internal innovations (Chesbrough, 2006). The growth of KIBS is seen as a trend that allows firms to remain focused on their core activities while seeking external knowledge to help them face growing competitive innovative pressure (Huggins, 2011).

Despite a growing stock of literature on the impact of KIBS in manufacturing innovation (Pace and Miles, 2020), the focus has shifted gradually towards outcomes for manufacturers, one of these being internationalization. In this line, Bottini and Tajoli (2010) found broad-based evidence of the relationship between the provision of KIBS and clients' exporting, noting that highly internationalized industries tend to use more KIBS. Shearmur *et al.* (2015) corroborate the findings of Bo-

ttini and Tajoli (2010), claiming that exporters use more KIBS than non-exporters and that they also use a wider variety of such services, emphasizing that the demand for KIBS seems to be driven by a company's innovativeness.

Hence our first RQ is *whether or not an increasingly demanding competitive environment leads to an increase in demand for KIBS by manufacturers.*

## 2.2. The internationalization of KIBS and reinforcement of the virtuous innovation-internationalization circle

Internationalization, like innovation, relies on knowledge (Fletcher and Harris, 2012; Shearmur *et al.*, 2015), or in other words, knowledge is a key resource and a driver of internationalization (Shearmur *et al.*, 2015). When firms decide to compete in international markets, external knowledge on new markets, regulations and laws, and on the logistics of international trade is needed in order to complement internal information (Fletcher *et al.*, 2013). The above cited Shearmur *et al.* (2015) point out that the expert advice exporters most commonly seek is related to innovation and management, and that the most demanded KIBS services are related to R&D, certification, and prototype testing, as well as management, human resources, legal advice and accounting. Internationalization impacts the extent to which firms demand KIBS since non-local markets compel firms to search for new knowledge and to challenge their innovation pressures (Bettioli *et al.*, 2012; Shearmur *et al.*, 2015). Besides, not only exporters engage more with KIBS, but manufacturers that use more KIBS could export more as Kamp and Ruiz de Apodaca (2017) suggest from the findings of a strong fit between KIBS consumptions and export figures for some screened sectors.

The literature on KIBS points out that the internationalization of clients is a trigger for KIBS to expand operations internationally (Roberts, 2000; Strambach, 2008). In addition, Toivonen *et al.* (2009) identify *«following a client to foreign markets»* as a possible path to the internationalization of KIBS but also mention the independent gradual internationalization of companies, and companies that are 'born global'. Focusing on the first of these, Huggins (2011) reports how London's legal firms *«tend to develop overseas bases following the movement of clients and the requirement to maintain face-to-face-contact»*.

While the main finding is that internationalization processes do involve KIBS, the literature also reflects the general perception that local cultural, regulatory and organizational knowledge is preferable and that services are better when provided face-to-face (Miles, 2005). Additionally, the dominant idea has been for a long time that knowledge spillovers are localized and distance hampers innovation (Simmie, 2003; Antonietti and Cainelli, 2008). Erramilli (1990) argues that KIBS firms differ from manufacturing firms when competing on international markets because *«hard»* services can be exported, while *«soft»* services can't. Despite this, the ongoing globalization of the economy is driving the development of KIBS by opening up

new markets. Di Maria *et al.* (2012) emphasized how knowledge codification and the role of network technologies can also help KIBS to manage customer relationships (and innovation-related processes) from a distance, thus facilitating their expansion into new markets. Moreover, as clients serve as a source of new and global knowledge, internationalization can be an important route for KIBS to access key assets when developing innovative solutions.

In the light of the above, our second research question is whether or not there is *a positive relationship between the internationalization of manufacturing firms and the internationalization of KIBS in terms of export growth.*

As we have said before, it is generally accepted that KIBS provide expertise on a range of diverse technological activities such as R&D, management, and IT outsourcing, (Strambach, 2001; Lafuente *et al.*, 2017; Horváth and Rabetino, 2019). However, it is widely documented in the literature that not all knowledge-intensive business services play the same role (Rodríguez *et al.*, 2018; Seclen-Luna *et al.*, 2020), and it is suggested to differentiate among KIBS branches since they are heterogeneous, mainly due to having different «knowledge bases» underpinning services and innovation in a differentiated manner (Pina and Tether, 2016; Strambach, 2008, Rodríguez *et al.*, 2018). In addition to the «mainstream» differentiation between technology-based KIBS (T-KIBS) and professional-based KIBS (P-KIBS) adopted by Miles *et al.* (2018), this paper also includes i) T-KIBS (R&D and other technical services); ii) C-KIBS (computer-related services) and iii) P-KIBS (legal services, consultancy and marketing services).

Our decision to include these categories stems from evidence that KIBS feature differential sub-sectorial specializations (Corrocher *et al.*, 2009) and that different problem-solving strategies are driven by different skill sets (Consoli and Elche Hortelano, 2010). This decision is also in line with literature arguments that: i) defend that different branches of KIBS have diverse effects on innovation (Vaillant *et al.*, 2021; Seclen-Luna *et al.*, 2022) and therefore have a heterogeneous impact on the results of companies and by extension on their internationalization and ii) while P-KIBS rely on tacit knowledge and are context specificity, T-KIBS are less context-specific and the technical and experimental knowledge once validated experimentally is more easily systematised (Rodríguez *et al.*, 2018) and C-KIBS are widely seen challenging traditional restrictive options for internationalization (Miles and Miozzo, 2015). Additionally, when studying KIBS internationalization it is also worthy to mention that there are key regulatory issues confronting international service operations within KIBS, impacting and hampering modes of supply in some service sectors (Molinuevo and Sáez, 2014).

Hence, our third research question concerns whether *a high degree of internationalization in the manufacturing sector leads KIBS to join the process of internationalization, and whether or not the internationalization of the manufacturing sector affects all KIBS categories in the same way.*



### 3. DATA SOURCE AND METHODOLOGICAL FRAMEWORK

The empirical research settings from which we have drawn the data are the regional contexts of the Basque Country and Catalonia. These two regions are deemed valid test settings as they constitute the traditional industrial heartlands of Spain. Moreover, employment in high and mid-high technology is higher in both territories than in the rest of Spain and the EU, while employment in KIBS is similar to the rest of Spain but lower than the EU average (See Table 1).

*Table 1.* **ECONOMIC INDICATORS OF THE BASQUE COUNTRY AND CATALONIA**

	Catalonia	Basque Country	Spain	EU28
GDP per capita (pps), 2020	29.600	32.400	25.200	29.900
Unemployment rate, 2020	12,6	9,5	15,5	7,1
Employment in manufacturing high and mid-high tech, 2019 (%)	6,4	8,6	3,6	5,8
Employment in knowledge intensive services, 2019 (%)	36,2	38,2	36,07	40,7

Source: Eurostat and Orkestra's Competitiveness indicators.

In order to conduct our analyses, we use statistical data obtained from the Input-Output tables (I-O tables) for the Basque Country and Catalonia provided by EUSTAT (Basque Statistical Institute) and IDESCAT (Statistical Institute of Catalonia), respectively, for the years 2001, 2005, 2011, 2014 and 2019 (the 2019 stats only refer to the Basque Country). It is worth highlighting that following methodological changes in the European Systems of Accounts (ESA 2010), the Input-Output relationships changed, and a certain degree of caution is recommended as regards homogeneity of the periods.

The I-O table is a «disaggregated analysis system, based on microeconomics, for modelling productive interactions among a wide range of products/economic activities» (Tarancón-Morán, 2003). This tool, which is part of the national accounting system, was developed based on four assumptions: sectoral homogeneity, relative price invariance, proportionality, and additivity (Hernández, 2012). The I-O methodology is suitable for analyzing the intensity of inter-industrial relationships based on the linkages between all the production inputs and the final goods (Antonioli *et al.*, 2020). The use of I-O tables to study KIBS has grown in recent years. For example, Di Cagno and Meliciani (2005) investigated the contribution of knowledge intensive business services to the growth of productivity and the fostering



of technological change. Evangelista *et al.* (2013) also used I-O tables to assess the strengths and innovative content of the linkages between clients and services. More recently and following this trend, Antonioli *et al.* (2020) investigated the role of KIBS in shaping the European Monetary Union (EMU) countries' structures using the World Input-Output Database (WIDO) to study intersectoral dynamics. Equally noteworthy is Przybylinsky and Wyszowska-Kuna's use of WIDO in their 2021 empirical study of the content of KIBS in EU trade. In a closer geographical environment, it is worth highlighting the work of Kamp and Sisti (2018) assessing the relationship between ICT services and the manufacturing industry from a meso-economic perspective on the basis of I-O analyses in Basque Country.

The basic I-O framework consists of three matrixes: the domestic-intermediate matrix, the domestic-demand matrix (which includes the final consumption by households and government, the gross fixed capital formation, and the exports), and the primary-inputs matrix. The columns for the intermediate-demand matrix show the purchasing structure of each sector, while the rows show sector-to-sector sales. The sectoral classification that allows us to differentiate between the manufacturing sector and the T-KIBS, C-KIBS and P-KIBS is shown in Annex 1. The I-O tables provide the direct input coefficient which is the quotient of  $x_{ij}$  (sales of product  $i$  to sector  $j$ ) and value added  $w_j$  (production of sector  $j$ ), while the direct output coefficient is the quotient between  $x_{ij}$  and final demand  $e_i$ . Finally, the data on the evolution of exports for the manufacturing and KIBS' sectors, respectively, are extracted from the final demand matrix of the I-O tables.

#### 4. RESULTS

The result of the analysis on the relationship between the manufacturing sector and the KIBS sectors and how they have evolved and expanded into the international market is structured around four subsections. First of all, in order to see whether a greater demand for KIBS is reflected in a greater flow of funds between the sectors, we assessed the direct technical coefficients of the flows between manufacturers and KIBS as follows: i) the manufacturing shares of the total intermediate demand for KIBS inputs (%) and ii) the KIBS inputs as a share of the total intermediate inputs (%). In the second section, the analysis is refined based on the typology of the KIBS. Thirdly, we investigated the monetary flows from exports and finally we examined the behavior of KIBS based on the typology of the services provided.

##### 4.1. Demand for KIBS in the manufacturing sector

The results of the first research question – *whether or not an increasingly demanding competitive environment leads to an increasing demand for KIBS in the manufacturing sector* – are presented in Table 2. The estimations were carried out using direct input and output technical coefficients for the whole KIBS sector in relation to the manufacturing sector.

As mentioned before, the input technical coefficient indicates the participation of KIBS as an intermediate consumption in the total intermediate inputs of the manufacturing sector. In this input technical coefficient indicator, we have distinguished between domestic (based in the region) and external KIBS (based outside the region). Table 2 shows a decreasing trend in the ratio of KIBS inputs as a share of the intermediate total demand of manufacturing. To be more exact, Catalonia reflects a decreasing trend while the Basque Country decreases after 2011. When comparing regional behavior, it is immediately apparent that KIBS inputs are more significant in the cost structure of Catalan manufacturers. Regarding these indicators in the Basque Country, domestic KIBS are clearly more dominant, whereas in Catalonia, the situation is similar but less marked, corroborating Wyszkwoka-Kuna (2018) who found that most KIBS operate in domestic markets.

**Table 2. KIBS SHARE OF THE TOTAL MANUFACTURING PRODUCTION (%)**

	2001	2005	2011	2014	2019
<b>Basque Country</b>					
Direct Domestic Input coefficients	1,96	2,28	2,70	2,65	2,32
Direct External Input coefficients	0,22	0,26	0,48	0,49	0,36
Direct Input coefficients	2,18	2,54	3,18	3,14	2,68
<b>Catalonia</b>					
Direct Domestic Input coefficients	3,19	3,75	2,71	2,16	
Direct External Input coefficients	1,77	1,75	2,15	1,73	
Direct Input coefficients	4,96	5,50	4,85	3,89	

Source: EUSTAT, IDESCAT I-O Tables, own calculation.

Direct Output coefficients reflect the output of KIBS consumed by manufacturing as intermediate inputs. The figures reflect a downward trend over the years, with a noticeably sharp drop between 2005 and 2011 which was due to the new branch recoding following the methodological changes in the European Systems of Accounts (ESA 2010) (see Annex 1). As shown in Table 3, manufacturing accounts for less than 12% of the demand for KIBS. It is noteworthy that the manufacturing sector in the Basque Country consumes more domestic KIBS than the manufacturing sector in Catalonia.

Table 3. **MANUFACTURING SHARE OF THE TOTAL DEMAND FOR KIBS (%)**

	2001	2005	2011	2014	2019
Basque Country					
Direct Domestic Output coefficients	11,59	9,22	6,48	6,54	5,79
Direct External Output coefficients	25,38	26,19	14,20	12,91	9,90
Catalonia					
Direct Domestic Output coefficients	9,17	8,80	6,50	5,54	
Direct External Output coefficients	38,13	31,54	25,87	20,93	

Source: EUSTAT, IDESCAT I-O Tables, own calculation.

#### 4.2. Demand for KIBS in the manufacturing sector according to KIBS type

When examining the demand evolution of the different KIBS categories, the results of the monetary flows between sectors become more nuanced.

Even though the T-KIBS sector was the one that was most affected by the methodological changes brought about by ESA 2010, we can still see that both the domestic and external coefficients grew steadily. The fact that the domestic input coefficient is preponderant compared to the external one is also noteworthy, reinforcing the notion of the importance of the territory's own knowledge resources. Among the so-called P-KIBS, the incidence of these KIBS in the cost structure of manufacturing is greater in Catalonia probably due to the metropolitan effect of Barcelona.

The output technical coefficient shows the importance of manufacturing for T-KIBS prior to 2011 and how the methodological changes affected the data. The figure for the manufacturing demand for external T-KIBS in Catalonia, while volatile, is particularly noteworthy. The C-KIBS coefficient was stable in the Basque Country although the domestic C-KIBS were marginally but consistently higher than the external C-KIBS, a finding echoed by Kamp and Sisti (2018). In Catalonia, the domestic C-KIBS output coefficients were slightly higher before 2011 but lost pace in favor of external C-KIBS. The output coefficient shows that the manufacturing sector is of marginal importance to the C-KIBS, a potential weakness in an economy that is heading towards industry 4.0 since these digital technology-based services are linked with smart manufacturing technologies such as artificial intelligence, real-time monitoring or robotics among others (Vaillant *et al.*, 2021). Regarding P-KIBS, the manufacturing demand for P-KIBS fluctuates around not insignificant 10% although this figure decreases somewhat in Catalonia at the end of the period.

**Table 4. KIBS SHARE OF TOTAL MANUFACTURING PRODUCTION ACCORDING TO TYPE OF KIBS (%)**

	2001			2005			2011			2014			2019		
	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS
<b>Basque Country</b>															
Direct Domestic Input coefficients	1,0	0,5	1,2	0,7	0,4	1,2	0,6	0,5	1,6	0,6	0,5	1,6	0,6	0,4	1,3
Direct External Input coefficients	0,1	0,0	0,3	0,0	0,0	0,2	0,0	0,0	0,4	0,0	0,0	0,4	0,1	0,0	0,3
Direct Input coefficients	1,1	0,5	1,4	0,8	0,4	1,4	0,6	0,5	2,0	0,6	0,5	2,0	0,7	0,5	1,6
<b>Catalonia</b>															
Direct Domestic Input coefficients	0,4	0,7	2,1	0,3	0,8	2,7	0,3	0,1	2,3	0,0	0,1	2,0	0,0	0,1	2,0
Direct External Input coefficients	0,1	0,1	1,6	0,1	0,1	1,5	0,2	0,3	1,6	0,0	0,4	1,4	0,0	0,4	1,4
Direct Input coefficients	0,5	0,8	3,7	0,4	0,9	4,2	0,5	0,4	3,9	0,0	0,5	3,4	0,0	0,5	3,4

Source: EUSTAT, IDESCAT I-O Tables, own calculation.

Table 5. MANUFACTURING SHARES OF TOTAL KIBS DEMAND BY TYPOLOGY OF KIBS (%)

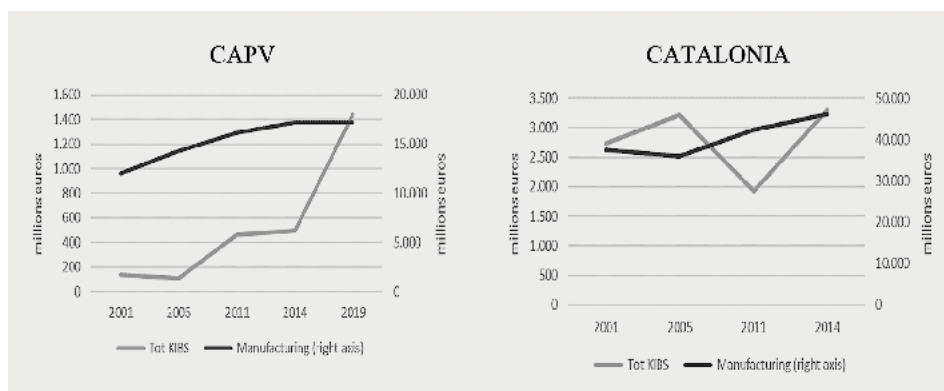
	2001			2005			2011			2014			2019		
	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS	T-KIBS	C-KIBS	P-KIBS
Basque Country															
Direct Domestic Output coefficients	28,2	6,9	9,73	24,1	4,2	8,95	4,4	4,1	10,24	4,3	4,3	4,3	4,5	3,7	3,7
Direct External Output coefficients	53,8	2,5	24,13	57,4	4,9	29,08	4,8	4,1	21,91	4	3,9	3,9	5,4	3	3
Catalonia															
Direct Domestic Output coefficients	22,2	6,7	9,32	14,5	6,1	9,56	5,6	1,5	8,15	0	1,5	1,5			
Direct External Output coefficients	6,61	9,9	43,66	31,1	12,9	34,59	78,9	13,3	28,52	0	12,9	12,9			

Source: EUSTAT, IDESCAT I-O Tables, own calculation.

### 4.3. KIBS openness to external markets

Knowledge is an important asset in the internationalization of firms (Fletcher and Harris, 2012) but when firms internationalize, they also generate an ongoing process of knowledge creation and learning (Shearmur *et al.*, 2015). Taking into account that this new global knowledge can be a source of new innovation for KIBS, we have also taken a closer look at the evolution of exports in the manufacturing and KIBS sectors. Figure 1 shows an increasing pattern both in manufacturing and KIBS exports in the Basque country, a finding that is not replicated in Catalonia. Manufacturing exports in Catalonia fell between 2001 and 2005 but managed to recover, however, the trend is not steady. KIBS exports increased at first but fell after 2005. Nonetheless, regarding exports of KIBS, the superior size of the Catalan economy has to be taken into account. It is also important to note that the 2005 starting figure for the Basque Country was €140 M.

Figure 1. MANUFACTURING AND KIBS EXPORTS



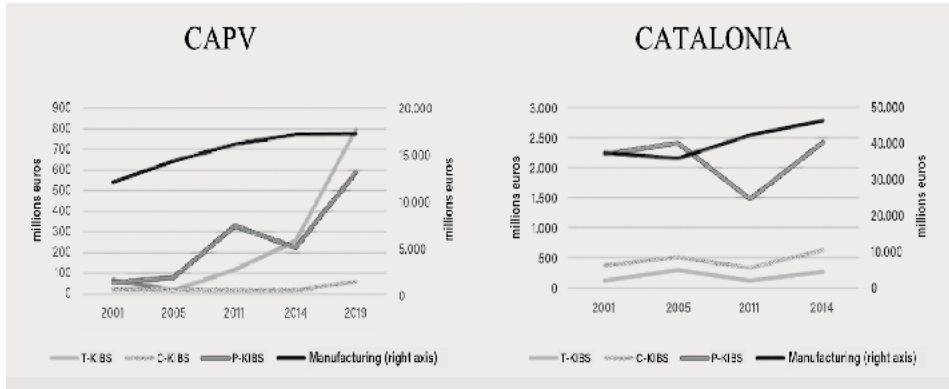
Source: EUSTAT, IDESCAT I-O Tables, own calculation.

### 4.4. Openness to external markets according to KIBS typology

When we assessed the exports figures, we noticed differences in behavior among the type of KIBS and the territories (see Table 6). In the Basque Country, the T-KIBS were the largest exporters from 2014. Since the 1980s, the regional Basque government has played an essential role in the creation and support of the T-KIBS subsector with a dedicated science and technology policy aimed at fostering technological centers similar to the Fraunhofer (Valdaliso *et al.*, 2011). In fact, this focus on technology centers has become a central feature of the government’s long-term policy (Aranguren *et al.*, 2017). By contrast, the Catalan T-KIBS are relatively modest exporters. However, the P-KIBS in Catalonia are responsible for most of the region’s exports which can be explained by the metropolitan nature of Barcelona, again underlining the impor-

tance of the urban context in KIBS (Gallego and Maroto, 2015; Horváth and Rabetino, 2018). Regarding the limited export ratio of the C-KIBS in the Basque Country it can be explained, as above has been mentioned, by the modest specialization index scores of this subsector reported by Kamp and Sisti (2018).

Table 6. KIBS'S EXPORTS BY TYPOLOGY



Source: EUSTAT, IDESCAT I-O Tables, own calculation.

Basque Country					
	2001	2005	2011	2014	2019
Manufacturing (right axis)	12.022	14.337	15.703	16.478	16.552
Tot KIBS	138	112	463	498	1.443
T-KIBS	12	17	117	256	795
C-KIBS	18	18	16	18	57
P-KIBS	108	77	330	224	590
Catalonia					
	2001	2005	2011	2014	
Manufacturing (right axis)	37.496	35.884	42.416	46.237	
Tot KIBS	2.732	3.212	1.927	3.314	
T-KIBS	124	297	121	270	
C-KIBS	381	511	333	626	
P-KIBS	2.228	2.403	1.472	2.418	

Source: EUSTAT, IDESCAT I-O Tables, own calculation.



## 5. DISCUSSION

This research aims to contribute to the scant empirical literature on KIBS in two ways. Firstly, we want to broaden the debate on interlinkages between the KIBS and manufacturing sectors by adding a study which combines an assessment of the demand for KIBS with an assessment of the exports from both sectors. Secondly, we offer a new view of the supply side by examining T-KIBS, C-KIBS and P-KIBS separately. This is consistent with recognizing the role of KIBS in the production and dissemination of knowledge in the current globalized learning economy but also takes into account that different problems require different inputs and skills.

The importance of the demand for KIBS in the manufacturing sector is of particular interest due to the link between the international competitiveness of manufacturing and the consumption of the KIBS as an intermediate input (Evangelista *et al.*, 2013). Regarding the first research questions about whether an increasingly demanding competitive environment increases the demand among manufacturers for KIBS, we have to say that the evidence does not support the proposition. If we look at the monetary flow between both sectors, we can see that the manufacturing sector has not increased its use of KIBS to procure innovative solutions. Therefore, the growth of KIBS has occurred thanks to other sectors. Neither is the value of KIBS in monetary terms the same for both territories; the KIBS share of the Catalan manufacturing total production is larger than in the Basque Country.

When investigating whether a positive relationship exists between the internationalization of manufacturing and the internationalization of KIBS, we found signs of the existence of two different economic realities. The growth in the internationalization of the manufacturing sector in the Basque Country is more constant although it slowed down at the end of the period. Accompanying this growth in manufacturing exports, KIBS exports increased sharply thanks to the export of T-KIBS, corroborating that T-KIBS as highly specialized services would internationalize better (Minondo, 2016), although it should be noted that they started out from a weaker position. By contrast, the manufacturing exports in Catalonia fluctuated depending on the period, and KIBS exports fell slightly due to the decline in the export of P-KIBS.

The question of whether growth in the internationalization of the manufacturing necessarily leads to growth in the internationalization of KIBS and whether or not the connection extends to all KIBS sectors equally points to a very important issue. The reason for the differences in behavior among the different types of KIBS in the Basque Country and in Catalonia may have its roots in the different institutional policies implemented in the two regions. Although C-KIBS are of secondary importance in both territories, P-KIBS play an important role in Catalonia, probably again due to the scale effect of Barcelona as a metropolitan area which determines the size of scale in the governance of institutional management.

Strambach (2001) already cites Barcelona when studying the fact of the concentration of KIBS in core metropolitan regions in Europe. T-KIBS are more dynamic in the Basque Country because of the government's policy to support them. The essence of such strategy is expressed in their Science, Technology and Innovation Plans (Valdaliso *et al.*, 2014), for example, the last and ongoing plan is the so-called PCTI-2019.

Therefore, as the export data 'by typology' correlate with the 'intensity of KIBS use' results, the data from the I-O tables signal the existence of a virtuous innovation-internationalization circle among the P-KIBS in Catalonia and the T-KIBS in the Basque Country.

## 6. CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Two decades researching the manufacturing sector, innovation in KIBS and internationalization in the Basque Country and Catalonia have allowed us to uncover trends and signs that suggest that the more exporting manufacturers use KIBS, the more likely the KIBS providers are to move into new foreign markets. In other words, KIBS companies are often 'pushed' into internationalization by their manufacturing clients. As a first contribution to the literature, this study points out that manufacturing-KIBS interrelation has not to be taken for granted and corroborates recent work from Elche *et al.* (2021), who against the established strand of literature, suggest that the interrelations between manufacturing and KIBS should be nuanced. It seems that KIBS and manufactures interrelate more when the level of technological intensity of manufacturing industries increase and have not achieved maturity in the life cycle. It is also significant that KIBS can break the barriers of distance and design business models according to the needs of their clients, accompanying them in their foreign markets (Di Maria *et al.*, 2012; Fletcher *et al.*, 2013; Miles and Mizzo, 2015). This insight into how the internationalization of manufacturers impacts the international activities of KIBS can shed some light on the subject and help policy-makers design appropriately targeted industrial and innovation policies with a view to enhancing the knowledge transfer capacity of KIBS from an internationalization perspective. This aim would require a careful design of regional policies that aim not only at the strengthening of the internationalization capacity of manufacturing, but also building on the existing strengths in services and supporting its specialization and international competitiveness. In addition, the KIBS-manufacturing symbiosis could be achieved by rejuvenating traditional sectors from policies that support territorial servitization (Lafuente *et al.*, 2019).

However, the study has limitations with implications for future research. Initially, we used I-O tables from the ESTAT and IDESCAT. This provided an excellent opportunity from the point of view of availability of data, but the methodological is-

sues resulting from the ESA 2010 changes in the European Systems of Accounts are reflected in the EUSTAT and IDESCAT I-O tables meaning we had to compare two periods instead of one, i.e., 2000 to 2005 and 2010 to 2019. Therefore, when explaining a trend over time, this break in the series should be taken into account and viewed with caution.

Regarding the study setting, one of the conclusions that can be drawn is that the financial and institutional context influences how KIBS behave, both in terms of innovation and internationalization, so it would be important to contrast the situation with that of other territories.

We used the term internationalization to refer to exports, but there are other forms of internationalization such as «joint ventures» and «direct investments» that fall outside the scope of this study.

Finally, this study should be considered for exploratory purposes only, particularly as we relied on quantitative data but did not establish a cause-effect relationship in the strict sense. For this reason, it is important to continue research in this field so as to identify sources of competitive advantage for both the manufacturing and KIBS sectors.

Therefore, regarding future research, we first recommend carrying out more qualitative research, and secondly, we suggest focusing on strategic industries – rather than the manufacturing sector – and examining the contribution of KIBS to innovation and internationalization by evaluating each territory's own resources and establishing which external KIBS are required to meet its needs.

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## ANNEX

## Annex I. KIBS CLASSIFICATION BY CODE

Basque Country	2001	2005	2011	2014	2019
T-KIBS	82.R&D (market)	82.R&D (market)	84. R&D	84. R&D	84. R&D
	83.R&D (non-market)	83.R&D (non-market)			
	85. Engineering services	85. Engineering services	83. Architectural, engineering and technical tests.	83. Architectural, engineering and technical tests.	83. Architectural, engineering and technical tests.
C-KIBS	75. Telecommunications	75. Telecommunications	76. Telecommunications	76. Telecommunications	76. Telecommunications
	81. Computer activities	81. Computer activities	77. Computer and information services	77. Computer and information services	77. Computer and information services
P-KIBS	84. Accounting legal services	84. Accounting legal services	82. Legal and accounting services and headquarters	82. Legal and accounting services and headquarters	82. Legal and accounting services and headquarters
	86. Advertising	86. Advertising	85. Advertising and marketing	85. Advertising and marketing	85. Advertising and marketing
			86. Other professional services	86. Other professional services	86. Other professional services

**KIBS CLASSIFICATION BY CODE**

Annex 1.

	2001	2005	2011	2014
Catalonia				
T-KIBS	56. Research and development services	56. Research and development services	72. Research and development services	72. Research and development services
C-KIBS	49. Postal and telecommunications services	49. Postal and telecommunications services	61. Telecommunications services	61. Telecommunications services
	55. Computer services	55. Computer services	62-63. Information services and information technologies	62-63. Information services and information technologies
P-KIBS	57. Other business services	57. Other business services	69-70. Legal, accounting, headquarters and consulting services	69-70. Legal, accounting, headquarters and consulting services
			71. Architectural and engineering technical services	71. Architectural and engineering technical services
			73. Advertising services and market research	73. Advertising services and market research
			74. Other professional and technical services; veterinarians	74. Other professional and technical services; veterinarians