



# Internationalisation Strategy of Knowledge-Intensive Business Services

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**Abstract** This paper is based on the results of a questionnaire sent to chief executive officers of KIBS firms in Portugal. The aim of this research is to explore the effects of knowledge, cooperation and innovation on their internationalisation strategy. The study used a quantitative approach, based on a sample extracted from the Survey of the Scientific and Technological Potential, with KIBS activity in 2014/2015. Upon the completion of data collection, systematisation of data was done through factor analysis and multiple linear regression that allowed conclusions to be drawn about the objectives proposed. On the one hand, our results show that knowledge personalisation has a positive influence on proactive strategies of internationalisation, such as external innovation and new organisation methods. When KIBS cooperate with clients, a positive impact on reactive and cost strategies of the internationalisation can be verified. On the other hand, reactive and cost strategies of internationalisation are negatively influenced by knowledge personalisation,

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knowledge sharing and internal innovation. This study contributes (1) to increase academic knowledge about this subject, (2) to the management practice, allowing firms to gain insights that may develop their proactive strategies of internationalisation and (3) to reinforce the need for adjustment of public policies to encourage the development and strengthening of proactivity of this sector with regard to internationalisation.

**Keywords** Internationalisation strategy · Innovation · Knowledge · Cooperation · KIBS

## Introduction

Knowledge Intensive Business Services (KIBS) refer to services involving economic activities, which are expected to result in the creation, accumulation or dissemination of knowledge. In addition, KIBS are key players in innovation systems, particularly in advanced regions where manufacturing competitiveness largely depends on knowledge contents provided by highly specialised suppliers. Over the last 20 years, authors (e.g. Abecassis-Moedas et al. 2012; Muller and Doloreux 2009; Simmie and Strambach 2006) have focused their research on understanding the potential implications of KIBS on innovation processes and on the competitiveness of both firms and economies. Pina and Tether (2016) argue that KIBS are increasingly recognised as among the most dynamic sectors of advanced economies, not only achieving high rates of innovation but also helping their clients to innovate. According to other authors (e.g. den Hertog 2000; Santos and Spring 2015), when focusing on the role of KIBS services in client innovation, KIBS are seen to function as facilitators, carriers or sources of innovation and, through their almost symbiotic relationship with client firms, some KIBS function as co-producers of innovation, not only through the cooperation with their clients but also with higher education institutions (HEI) and other organisations. Often KIBS act as transmitters of knowledge, contributing in different ways to the innovation processes of related firms (Haukness 1998; Miles et al. 1995).

In addition, some recent papers have shown the relevance of these firms in the process of entering new foreign markets (Di Maria et al. 2012; Doloreux and Laperriere, 2014). At the same time, innovation has played an important role in internationalisation (Rodriguez and Nieto 2012; Rodriguez and Nieto 2010) and it is, often, the channel for firms to increase productivity (Altomonte et al. 2013). While a growing amount of research emphasises internationalisation, little academic research focuses on its consequences on innovation strategies and activities (Doloreux and Laperriere 2014; Marques et al. 2016; Marques et al. forthcoming). The value of the present study lies in a better understanding of the association between distinct strategies of internationalisation, management knowledge, cooperation and innovation in KIBS firms.

In the present research, we aim to explore the effects of knowledge, cooperation and innovation on internationalisation, sending questionnaires to CEOs of Portuguese KIBS firms. In addition, we aim to contribute to management practices by offering firms a deeper knowledge of forms to increase competitiveness, particularly in relation to both KIBS and business clients from any activity sector, and to provide some suggestions and improvements for national adjustment policies.

This study used a quantitative approach, based on a sample extracted from the Survey of the Scientific and Technological Potential, with KIBS activity in 2014/2015. Upon completion of the data collection, systematisation of data was done through the

use of factor analysis and multiple linear regression that allowed for conclusions to be drawn about the goals we proposed to achieve.

This paper is structured as follows: The next section examines theories supporting the hypotheses that involve the possible relationships between internationalisation, knowledge, cooperation and innovation. After discussing some methodological considerations, the results are presented, and the chapter concludes with a reflection on the study's most important limitations and implications for management practice, as well as suggestions for future avenues of research.

## Theoretical Background and Hypotheses

### Internationalisation

The internationalisation of KIBS creates challenges in spite of their specificities, such as knowledge intensity, the importance of customer interaction and intimacy in service delivery (Abecassis-Moedas et al. 2012).

Firms beginning to internationalise may struggle to absorb knowledge from sources from foreign markets, as their primary sources of knowledge are internal staff and clients. Product and process innovations are the dominant types of innovations developed by these firms, most likely due to the fact that they must adapt themselves to new markets. Comparatively, firms with greater internationalisation experience (as identified in the study of Doloreux and Laperriere 2014) as those with a greater share of foreign sales were more likely to develop new strategies to better exploit and diffuse their service offering in different international markets. This is reflected by the fact that these firms introduced strategic and managerial innovations more frequently on the market than firms with lower international activity.

In general, the motivations of firms to internationalise can be grouped in two types: proactive and reactive motivations (Czinkota et al. 2004). Proactive motivations represent stimuli to attempt strategic change. Reactive motivations influence firms that are responsive to environmental changes and adjust to them by changing their activities over time. In other words, proactive firms go international because they want to, while reactive ones go international because they have to.

The choice of the knowledge management strategies and processes (López-Nicolás and Meroño-Cerdán 2011; Lanza 2005), cooperation partners (Fernandes and Ferreira 2013; Walsh et al. 2016) and innovation sources (Cassiman and Veugelers 2006; Poot et al. 2009) can influence the internationalisation strategies.

### Knowledge

According to the literature, KIBS play a role in facilitating innovation by interfacing between the generic knowledge available in the economy and the tacit knowledge located within firms (Kubota 2009).

Hansen et al. (1999) differentiate between two types of knowledge management: personalisation and codification. According to the quoted authors, personalisation focuses on dialogues between individuals, while codification extracts knowledge from the individuals who develop it and reutilise this knowledge to achieve various purposes.

Thus, for some authors (López-Nicolás and Meroño-Cerdán 2011; Wu and Lin 2009), organisations have to find a good balance between system strategies for codification and those strategies that concentrate more directly on human factors through personalisation. In this context, researchers suggest that personalisation, which focuses on tacit knowledge, is more valuable when firms seek to reinforce competitiveness and codification, which is especially valuable when the latter concentrates on explicit knowledge (Storey and Hahn, 2010).

According to Capasso et al. (2005), the past decade has seen an increase in the literature focusing on generating processes that share, identify and transfer knowledge within and between firms. Lanza (2005) reinforces Dyer and Nobeoka's (2000) finding that the development of new knowledge—along with the concurrent partners—has increasingly been undertaken in order to obtain a competitive advantage through improved product quality and innovation, despite the great difficulty and risk that these tasks entail. Lanza (2005) adds that this knowledge development process consists of two related phases: sharing and creating. Thus, competing businesses' knowledge sharing with partners is a key step for effective knowledge creation activities that allow firms to compete successfully in the market.

Knowledge and learning were also found to have a fundamental impact on internationalising firms as they must assimilate and exploit newly acquired knowledge to compete and grow in markets of which they have little to no prior knowledge (Autio et al. 2000).

Therefore, the following hypothesis was developed for the present study:

- H1—Knowledge has a positive influence in internationalisation.

## Cooperation

Innovation processes are systemic and interactive in nature. Therefore, firms hardly ever innovate on their own but rather in cooperation with various agents. External sources of innovation such as clients, suppliers, competitors and universities can be considered the main elements of a firm's search strategy. Previous studies have recognised the strategic importance of a wide range of knowledge sources for driving innovation (Sofka and Grimpe 2010; Greco et al. 2016), and for achieving not only product but also process innovations (Huang and Rice 2012). Fernandes and Ferreira (2013) also conclude that geographic proximity does influence cooperation between KIBS firms and higher education institutions (HEI) and, in turn, this cooperation influences the capacity to undertake and generate innovation.

The complex nature of the innovation process makes it increasingly necessary for firms to cooperate with other organisations in order to carry out their research and development initiatives. Therefore, the more intensely the firms interact with these external agents through cooperation agreements, the more likely it is to learn about new opportunities.

Previous research suggests that a firm can improve its innovation performance by interacting with different partners. Tomlinson (2010) finds that inter-firm collaboration with suppliers, buyers and competitors drives product and process innovation. Belderbos et al. (2004) find that R&D cooperation has a positive effect on innovative performance (financial and non-financial, like conquest of new markets), although the

impact varies according to the type of partner. In this sense, Walsh et al. (2016) argue that heterogeneous collaborations (i.e. university–industry) increase the quality of inventions while vertical collaborations (i.e. collaborations with suppliers or customers) increase commercialisation rates of inventions.

Within this dimension, relationships can be informal agreements or cooperative arrangements. Regarding the types of relationships between actors, Conway (2000) proposes two different forms of networks: (1) informal or social networks are those based on social relations created within businesses, and (2) formal networks are those that happen between firms as formal organisations. Blundel and Smith (2001) also studied business networking and found four different approaches: (1) industrial districts and spatial clusters, (2) supply chain networks, (3) entrepreneurial networks and (4) innovation networks.

Cooperation ventures can vary according to their goals. Nevertheless, this does not mean that networks have to embody just one aim, as they can involve multi-purpose cooperation. In some cases, cooperation is regarded as just a locus for innovation. In this sense, firms and HEI join together in order to innovate.

As some studies reveal (Rodríguez and Nieto 2010; Rodríguez and Nieto 2012), collaboration between firms and innovation are both relevant for the internationalisation of KIBS. Various authors (Keeble et al. 1998; Welch 1992) argue that alliances allow firms to ease or accelerate the internationalisation process by providing them with access to partners' resources and capabilities that they need for international operations.

According Rodríguez and Nieto (2010) a positive relationship between cooperation, innovation and internationalisation of KIBS is also found. Thus, the results confirm the relevance of innovation for internationalisation. KIBS that establish collaborative relationships gain easier access to international markets easier and improve their innovation capability. Thus, cooperation is found to be both directly and indirectly related to internationalisation in KIBS.

As a result of these findings, the following hypothesis was defined for the present study:

- H2—Cooperation has a positive influence on internationalisation.

## Innovation

KIBS are part a category of service activities that are often highly innovative and facilitate innovation in other organisations. Den Hertog (2000) suggests that KIBS function as facilitators, carriers or sources of innovation, and, through their almost symbiotic relationship with client firms, some KIBS function as co-producers of innovation (den Hertog 2000; Mas-Vérdu et al. 2011; Muller and Doloreux 2009). According to Flikkema et al. (2007), innovations can be classified as technological when they apply to products/services or processes or as non-technological innovations when referring to organisational and marketing aspects. Johnson et al. (2003) point out that traditionally, studies of innovation have focused much more on technological rather than non-technological innovation, and service and organisational innovation has been relatively neglected. Technological innovation, as a part of innovation activities, was one of the first approaches used in innovation activities. Schumpeter (1934) distinguishes between five types of innovation.

Two varieties exist in technological innovations (i.e. the introduction of new products and of new processes), while the remaining three are connected to non-technological innovation (i.e. opening new markets, developing new sources of raw materials and creating new organisational structures).

The production of services is often, according to den Hertog (2000), the result of a joint effort of the service provider and client. In this co-production process, the quality of the resulting service product largely depends on the quality of interactions and communication between the service provider and client. This author suggests an analyses of the role of KIBS in innovation processes, on the ways in which knowledge is produced and used in the economy, as well as the role of KIBS in these processes. The cited author further argues that in addition to discrete and tangible forms of knowledge exchange, process-oriented and intangible forms of knowledge flows are crucial in these relationships.

More innovative firms can better compete and thus become more internationalised. Internationalisation implies innovation (Boermans and Roelfsma 2015), not only because innovations allow firms to enter new markets (van Beveren and Vandenbussche 2010) but also because internationalisation facilitates access to inputs that are not available in domestic markets (Salomon and Shaver 2005).

The relationship between innovation and export has often been researched from the perspective that innovation precedes foreign market entry, and that exports are positively associated with knowledge accumulation and innovation activities (Leon-Ledesma 2005; DiPietro and Anoruo 2006).

Past research has also demonstrated that innovation is directly linked to internationalisation (Moreira et al. 2013; Ripolles Melià et al. 2010).

On the basis of the above evidence, we propose the following hypothesis:

- H3: Innovation has a positive influence on internationalisation.

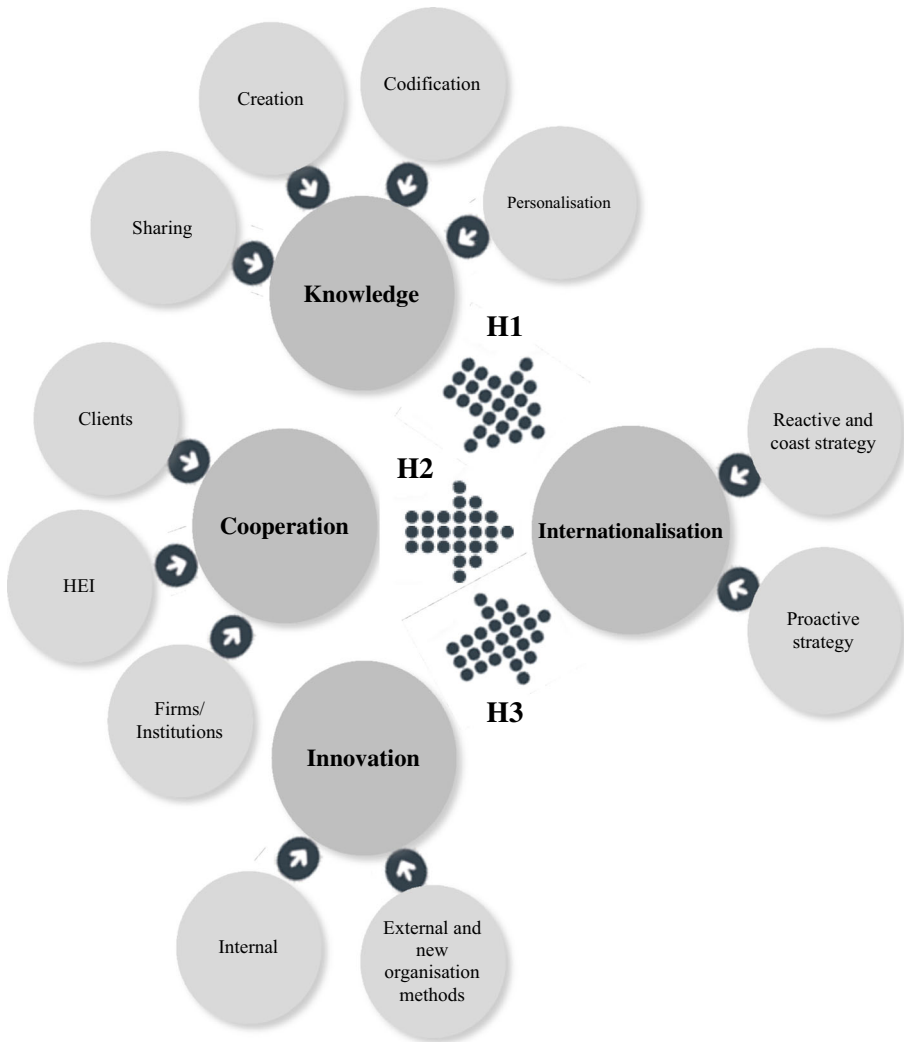
Based on the literature review, a conceptual model of research was proposed, as shown in Fig. 1 below.

## Methodological Strategy

In this study, we used a quantitative methodology, applying questionnaires to CEOs of KIBS firms in Portugal, in a sample of firms that were in operation in 2014 and 2015. With this research, we aim to explore the effects of knowledge, cooperation and innovation on internationalisation. These constructs were validated using confirmatory factor analysis, studying the reliability of a questionnaire, previously validated through interviews with CEOs and academic experts (national and international), specialists in KIBS and innovation to describe the structural relationships between the variables.

## Data-Source and Procedures

In order to test the proposed research model and research hypotheses, data was collected via a structured questionnaire distributed online to 397 firms that were listed as in operation, and contact was available in the database of the Inquérito ao Potencial



**Fig. 1** Conceptual model of research

Científico e Tecnológico Nacional (Survey of National Scientific and Technological Potential). This survey is conducted every year throughout Portugal. The surveyed firms were selected from the last reported year (i.e. 2012) based on their claim to have carried out research and development (R&D) activities and integrated four sectors: businesses, government institutions, HEIs and private non-profit organisations. The data collection took place from May to December 2015. Valid questionnaires were obtained from 58 firms (approximately 15% response rate).

### Measures and Sample

In order to refine and operationalise the variables, we conducted a further literature review and adapted scales validated in previous studies. The survey included questions selected

from four instruments: Community Innovation Survey, CIS (2012), Fernandes (2011), Hashi and Stojčić (2013) and López-Nicolás and Meroño-Cerdán (2011) (see Table 1).

The dataset used in this study consists of 58 KIBS firms and included 64 variables concerning strategies of internationalisation, cooperation, knowledge and innovation. Data were collected from Portuguese KIBS chief executive officers (CEOs). The 64 variables were grouped into six sections of items in the questionnaire, for which some descriptive statistics are provided in Tables 2, 3, 4 and 5 below. All the items were measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Questions about strategies of internationalisation, referring to nine five-point items, show means between 3.3 (proactive strategies) and 2.06 (reactive and costs strategies), with a standard deviation of approximately two 1.2. Relies about knowledge, covered by 15 items, display means between 2.96 (knowledge sharing processes) and 4.26 (personalisation), with a standard deviation of approximately 2. Answers concerning the 29 items about cooperation (i.e. HEIs, clients and other firms/institutions) have means between 2.13 (cooperation with HEIs) and 4.04 (cooperation with clients), with a standard deviation of around 1. Answers concerning the nine items about innovation (i.e. internal and external innovation) have means between 3.7 (internal innovation) and 3.1 (external innovation and new organisation methods), with a standard deviation of around 1.1.

In this study, we did a factor analysis of the scales used to measure internationalisation, knowledge, cooperation and innovation, as well as a multiple linear regression. The objective of the factorial analysis was to reduce the initial number of variables while keeping their common characteristics. Linear regression was performed in order to estimate the contribution of different factors for co-creation of technological and non-technological innovation. All of the statistical analyses presented were performed using IBM SPSS 22.0.

**Table 1** Theoretical foundations of scales used

Variables	Dimensions and items	Theoretical foundation
Internationalisation	11 items divided into 2 dimensions: <ul style="list-style-type: none"> <li>• Proactive strategies—8 items</li> <li>• Reactive and cost strategies—3 items</li> </ul>	CIS (2012)
Innovation	9 items divided into 2 dimensions: <ul style="list-style-type: none"> <li>• Internal innovation—4 items</li> <li>• External innovation and new organisation methods—5 items</li> </ul>	CIS (2012)
Knowledge	15 items divided into 4 dimensions: <ul style="list-style-type: none"> <li>• Personalisation—4 items</li> <li>• Codification—4 items</li> <li>• Sharing—4 items</li> <li>• Creation—3 items</li> </ul>	López-Nicolás and Meroño-Cerdán (2011) CIS (2012)
Cooperation	29 items divided into 3 dimensions: <ul style="list-style-type: none"> <li>• Clients—10 items</li> <li>• HEI—9 items</li> <li>• Other Firms/institutions—10 items</li> </ul>	Fernandes (2011) CIS (2012)



## Results

### Principal Components Analysis

In this section, we describe the results of the above-mentioned factor analysis and linear regression to present and discuss the findings.

For all dimensions under study, we started by confirming if principal components analysis (PCA) was an adequate method by using Bartlett's sphericity test, Kaiser-Meyer-Olkin (KMO) statistics and anti-image. Subsequently, we computed the principal components, loadings and communalities. The decision on the number of components to retain was a compromise between maximising the explained initial dataset variability and reducing the initial number of variables. In order to express the common variability between the initial variables, rotation was performed and the factors obtained.

Using the PCA method, the variables concerned with 'Strategies of internationalisation' were reduced from 11 variables to only two components (see Table 2). The KMO statistic is 0.76. Therefore, since  $0.7 < 0.756 < 0.8$ , we concluded that there is an average adequacy of the PCA because about 80% of the correlations are significant (Hair et al. 2014). When the Bartlett's test, in which the null hypothesis is the identity correlation matrix, has a  $p$  value of approximately  $0 < 0.05$ , then the null hypothesis can be rejected, and it is possible to conclude that the correlations between the involved variables are sufficiently high. Therefore, we concluded that running a PCA was adequate in this context.

According to the Kaiser criterion, when a correlation matrix is used, all components corresponding to eigenvalues smaller than one should be excluded. Applying this criterion, the first two components were extracted, as these explained a total of

**Table 2** Component and item statistics—Strategies of internationalisation

Component/item	Component loading	Sample adequacy	Item-total correlation	Mean	Standard deviation
Proactive strategies ( $\alpha = 0.924$ )				3.308	
Scale economies achievement	0.874	0.793	0.819	3.24	1.445
Risk diversification	0.868	0.804	0.817	3.20	1.364
Exploration of own skills	0.860	0.839	0.825	3.39	1.262
Firm's growth needs	0.831	0.713	0.804	3.68	1.491
Improve margins and profitability	0.807	0.800	0.790	3.44	1.285
Internationalisation arises from innovation processes	0.805	0.929	0.770	3.32	1.386
Strangulation of domestic market	0.724	0.731	0.646	3.37	1.280
Monitoring of important clients	0.611	0.671	0.491	2.83	1.395
Reactive and costs strategies ( $\alpha = 0.807$ )				2.057	
Proximity to sources of raw materials	0.877	0.668	0.762	1.80	0.954
Cheap labour demand	0.846	0.633	0.741	1.83	0.919
Reaction to performance competition	0.618	0.628	0.570	2.54	1.416

70.5% of the total variance in the original data; 47.4% is related to the first factor and 23.1% to the second one. The remaining components were excluded for having eigenvalues smaller than one.

Using the PCA method, the variables related to ‘Knowledge’ were reduced from 15 variables to four components (see Table 3). Using the same criterion as in the previous analysis, the first four components were extracted, which explained a total of 64.4% of the total variance in the original data, with 19.7% related to the first factor, 17.3% to the second, 14.6% to the third and 12.8% to the fourth factor. The remaining components were excluded for having eigenvalues smaller than one. The KMO statistic is approximately 0.7, and the  $p$  value for Bartlett’s test shows that the correlation matrix is significantly different from the identity matrix. Therefore, a factorial analysis could be

**Table 3** Component and item statistics—Knowledge

Component/item	Component loading	Sample adequacy	Item-total correlation	Mean	Standard deviation
Personalisation ( $\alpha = 0.820$ )				3.936	
Receives advice from supervisor	0.913	0.679	0.781	4.15	0.841
Carries out informal meetings to share knowledge	0.832	0.730	0.712	3.91	1.181
Enjoys a close relationship with a mentor who facilitates the transfer of knowledge	0.672	0.839	0.621	3.68	1.156
Shares knowledge easily with co-workers	0.600	0.750	0.584	4.26	0.880
Creates knowledge through cooperation with customers	0.551	0.611	0.428	3.68	0.976
Codification ( $\alpha = 0.715$ )				3.264	
Shares experiences with other firms	0.727	0.740	0.476	3.15	1.099
Establishes protocols about how to share knowledge inside the firm	0.678	0.684	0.534	3.32	1.384
Establishes protocols about how to share knowledge outside the firm	0.624	0.568	0.554	3.11	1.396
Shares knowledge through manuals and internal documents	0.623	0.738	0.405	3.53	1.012
Takes minutes of meetings to document results of projects and working groups	0.566	0.590	0.413	3.21	1.291
Knowledge creation and acquisition ( $\alpha = 0.700$ )				3.591	
Creates firm priorities and builds up knowledge and dissemination	0.809	0.736	0.644	3.83	1.014
Learns from other organisations	0.803	0.658	0.524	3.53	0.868
Acquires knowledge easily through manuals and documents	0.538	0.780	0.404	3.42	0.989
Knowledge sharing ( $\alpha = 0.681$ )				3.255	
Shares knowledge with clients	0.816	0.531	0.519	3.55	1.030
Shares knowledge with staff and other firms	0.748	0.554	0.519	2.96	0.940

**Table 4** Component and item statistics—Cooperation

Component/item	Component loading	Sample adequacy	Item-total correlation	Mean	Standard deviation
Cooperation with clients ( $\alpha = 0.913$ )				3.418	
Reduces overall costs	0.832	0.708	0.791	2.98	1.378
Learns with a cooperation partner	0.809	0.677	0.694	3.40	1.107
Shares technology and knowledge	0.795	0.693	0.754	3.52	1.111
Suggests ideas for improving products (goods/services) or processes	0.786	0.677	0.717	4.04	1.009
Elevates operational efficiency	0.782	0.646	0.722	3.52	1.313
Develops new products and/or processes	0.763	0.739	0.715	3.86	1.143
Develops new concepts	0.739	0.582	0.653	3.56	1.280
Generates formal and informal exchanges of people and ideas	0.703	0.557	0.692	3.30	1.199
Expands market share in geographical area of operation	0.579	0.787	0.555	3.72	1.341
Shares R&D costs	0.558	0.803	0.555	2.28	1.089
Cooperation with HEIs ( $\alpha = 0.892$ )				2.757	
Shares technology and knowledge	0.867	0.596	0.782	3.04	1.351
Develops new concepts	0.802	0.601	0.722	2.98	1.327
Develops new products and/or processes	0.786	0.592	0.687	3.17	1.291
Learns with a cooperation partner	0.733	0.513	0.676	3.09	1.248
Generates formal and informal exchanges of people and ideas	0.725	0.585	0.647	3.06	1.389
Shares R&D costs	0.715	0.678	0.602	2.13	1.115
Increases operational efficiency	0.683	0.609	0.681	2.79	1.334
Expands market share in geographical area of operation	0.650	0.562	0.627	2.26	1.113
Reduces overall costs	0.452	0.521	0.411	2.30	1.121
Cooperation with other organisations ( $\alpha = 0.938$ )				3.067	
Suggests ideas for improving products (goods/services) or processes	0.848	0.622	0.799	3.64	1.317
Generates formal and informal exchanges of people and ideas	0.830	0.712	0.820	3.13	1.236
Increases operational efficiency	0.819	0.534	0.788	3.18	1.302
Expands market share in geographical area of operation	0.788	0.702	0.674	3.29	1.254
Shares technology and knowledge	0.784	0.772	0.762	3.07	1.232
Learns with a cooperation partner	0.773	0.804	0.762	3.27	1.268
Develops new products and/or processes	0.766	0.720	0.743	3.29	1.424
Develops new concepts	0.750	0.718	0.775	2.91	1.411
Reduces overall costs	0.736	0.542	0.665	2.58	1.215
Shares R&D costs	0.709	0.813	0.729	2.31	1.145

performed. We performed a varimax rotation and suppressed coefficients with an absolute value below 0.35, obtaining the scores presented in Table 3. Since all factorial scores are greater than 0.5, no items were eliminated from the analysis, and we considered the factor with the highest score value from each item. Cronbach's alpha for the first factor is greater than 0.8, which indicates high reliability. The other factors' alphas are close to 0.7, which indicates medium reliability (see Hair et al. 2014).

Using the PCA method, the variables concerned with 'Cooperation' were reduced from 29 variables to only three components (see Table 4). The first three components were extracted, as these explained a total of 71.6% of the total variance in the original data. The remaining components were excluded for having eigenvalues smaller than one. The KMO statistic is approximately 0.71, and the *p* value for Bartlett's test shows that the correlation matrix is significantly different from the identity matrix, so a factorial analysis could be performed. We then performed a varimax rotation and suppressed coefficients with an absolute value below 0.35, obtaining the scores presented in Table 4. Since all factorial scores are approximately equal to or greater than 0.5, no items were eliminated from the analysis, and we considered the factor with the highest score value from each item. Cronbach's alphas for the three factors are greater than 0.89, which indicates high reliability (see Hair et al. 2014).

Using the PCA method, the variables related to 'Innovation' were reduced from nine variables to only two components (see Table 5). The first two components were extracted, as

**Table 5** Component and item statistics—Innovation

Component/item	Component loading	Sample adequacy	Item-total correlation	Mean	Standard deviation
Internal innovation ( $\alpha = 0.833$ )				3.733	
New or significantly improved services launched on the market	0.842	0.713	0.744	3.86	1.137
Activities to support the processes of new or improved business	0.836	0.839	0.667	3.68	1.121
New or significantly improved processes launched in the market	0.779	0.793	0.636	3.80	1.095
New business practices in the organisation of procedures	0.731	0.804	0.604	3.59	1.069
External innovation and new organisation methods ( $\alpha = 0.769$ )				3.193	
New pricing policies for services	0.831	0.668	0.685	3.08	1.193
New techniques or media (Media) to the promotion of services	0.816	0.929	0.631	3.15	1.186
New methods of distribution/placement services or new sales channels	0.725	0.633	0.593	2.98	1.196
New methods of organisation of responsibilities and decision-making	0.597	0.731	0.460	3.46	1.222
New methods of organising external elations with other firms or public institutions	0.529	0.800	0.346	3.29	1.160

these explained a total of 59.7% of the total variance in the original data: The first factor explained 30.2% and the second one 29.5%. The remaining components were excluded for having eigenvalues smaller than one. The KMO statistic is approximately 0.659, and the  $p$  value for Bartlett's test shows that the correlation matrix is significantly different from the identity matrix, so a factorial analysis could be performed. We then performed a varimax rotation and suppressed coefficients with an absolute value below 0.35, obtaining the scores presented in Table 5. Since all factorial scores are approximately equal to or greater than 0.5, no items were eliminated from the analysis, and we considered the factor with the highest score value from each item. Cronbach's alpha for the first factor is greater than 0.8, which indicates high reliability. The second factor's alpha is close to 0.8, which indicates medium reliability (see Hair et al. 2014).

By analysing the correlation matrix (Table 6) and the significance level of 10%, we were able to observe a significant positive correlation between 'cooperation with clients' and 'knowledge sharing', 'cooperation with HEIs' and 'knowledge creation', 'external innovation and new organisation methods' and 'proactive strategies' of internationalisation. 'Proactive strategies' of internationalisation have a positive correlation with 'personalisation' and 'cooperation with clients'. 'Reactive and cost strategies' of internationalisation have a positive correlation with 'cooperation with clients'. However, we found a negative correlation between 'cooperation with HEIs' and 'knowledge sharing'. This result reinforces the idea that higher education institutions still assume a passive role in knowledge sharing.

### Multivariate Regression Analysis

We also examined the previously tested relationships using two linear regressions with the dependent variables 'proactive strategies' and 'reactive and cost strategies' and the dependent variables of factors related with knowledge, cooperation and innovation (results in Table 7).

Assumptions of multiple linear regression are normality of the dependent variables, no multicollinearity and homoscedasticity.

The  $p$  values for Kolmogorov-Smirnov and Shapiro-Wilks tests of normality are greater than 5%, then we cannot consider normality.

The variable 'proactive strategies' displays a skewness statistic  $-0.624$  with standard error  $0.369$  and consequently skewness coefficient  $G = -1.690 > -1.9$  and Kurtosis statistic  $-0.284$  with standard error  $0.724$  and consequently, Kurtosis coefficient  $K = -0.392 > -1.9$ .

The variable 'reactive and costs strategies' shows a skewness statistic  $0.225$  with standard error  $0.369$  and consequently skewness coefficient  $G = 0.608 < 1.9$  and Kurtosis statistic  $-1.733$  with standard error  $0.724$  and consequently, Kurtosis coefficient  $K = -2.392$ , which is not much less than  $-1.9$ .

Then independent variables have symmetric and mesokurtic distributions and consequently, can be considered approximately normal.

In Table 6, Correlation matrix shows that we can see many correlation coefficients among all independent variables are smaller than 0.08. We can test the multiple linear regression model for autocorrelation with the Durbin-Watson test. Durbin-Watson statistics in the first regression is 1.701 and in the second 2077. Values of  $1.5 < d < 2.5$  show that there is no autocorrelation in the multiple linear regression data.

**Table 6** Correlation matrix

	K1	K2	K3	K4	CO1	CO2	CO3	Int1	Int2	Int1	Int2	ln1	ln2
Personalisation (K1)	1												
Codification (K2)	0.000	1											
Knowledge creation (K3)	0.000	0.000	1										
Knowledge sharing (K4)	0.000	0.000	0.000	1									
Cooperation with other firms/institutions (CO1)	-0.204	-0.180	-0.012	0.006	1								
Cooperation with clients (CO2)	0.152	-0.012	0.269	0.516**	0.000	1							
Cooperation with HEIs (CO3)	-0.035	0.203	0.312*	-0.317*	0.000	0.000	1						
Proactive strategies (Int1)	0.407**	-0.017	0.136	0.078	-0.237	0.413**	-0.084	1					
Reactive and cost strategies (Int2)	-0.257	0.074	0.089	-0.210	-0.011	0.443**	0.297	0.000	1				
Internal innovation (ln1)	0.189	-0.058	0.207	-0.063	-0.092	0.227	0.156	0.240	-0.127	1			
External and new organisation methods (ln2)	0.250	0.031	0.019	0.062	0.035	0.224	0.063	0.398**	0.131	0.000	1		

\* $p < 0.05$ ; \*\* $p < 0.01$

**Table 7** Standardised coefficients of linear regressions. Depend variable—internationalisation

	Proactive strategies	Reactive and cost strategies
Personalisation	0.360*	−0.357*
Cooperation with clients	—	0.893***
Knowledge sharing	—	−0.650***
External innovation and new organisation methods	0.365*	—
Internal innovation	—	−0.293*
R	0.546	0.824
R Square	0.298	0.679
Adjusted R Square	0.259	0.641

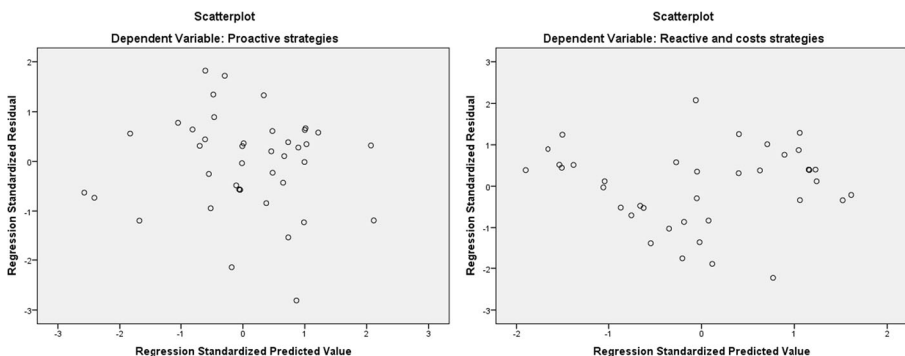
\* $p < 0.05$ ; \*\*\* $p < 0.000$

The last assumption that the multiple linear regression analysis makes is homoscedasticity. We can see that in Fig. 2, Scatterplots, shows a random distribution of points around zero, then homoscedasticity is verified.

The adequacy of the linear models depends of their residuals. They must be white noise, i.e. must have a normal distribution with zero mean and constant variance and the residuals must be independent. Using the Kolmogorov-Smirnov and Shapiro-Wilk, normality tests are obtained with high  $p$  values then a normal distribution of residuals, in the two regressions, can be assumed. Homoscedasticity was observed above as well as residuals independence thought Durbin-Watson's results.

The linear regression was implemented using the 'Enter' method to introduce variables, but the Wald test of parameters significance showed non-significant  $p$  values, so a stepwise method was performed using Akaike information criterion to insert or remove independent variables. The initial tested linear model is as follows:

$$\begin{aligned} \text{Internationalisation (proactive strategies + reactive and cost strategies)} = & \beta_0 + \beta_1 * \text{knowledge} \\ & (\text{codification + personalisation + creation + sharing}) + \beta_2 * \text{cooperation with} \\ & (\text{clients + HEIs + other organisations}) \\ & + \beta_3 * \text{innovation (internal, external)} \end{aligned}$$

**Fig. 2** Scatterplots

The best linear model, according to this criterion, is the one that has the coefficients presented in Table 7.

Table 7 shows two multivariate linear regression models for internationalisation (the first one for ‘proactive strategies’ and the second one for ‘reactive and cost strategies’). ANOVA tests were performed for the linear models and significant levels were obtained ( $p = 0.002$  for ‘proactive strategies’ and  $p = 0.000$  for ‘reactive and cost strategies’).

These results show that knowledge ‘personalisation’ and ‘external innovation and new organisation methods’ explain more than 29% of ‘proactive strategies’ variance (confirmed H1 and H3). The regression coefficient of ‘personalisation’ is 0.36, which means that, when ‘personalisation’ increases 1%, ‘proactive strategies’ increase approximately 36%, and when ‘external innovation and new organisation methods’ increases 1%, ‘proactive strategies’ increases about 36.5%. In addition, ‘personalisation’, ‘knowledge sharing’, ‘cooperation with clients’ and ‘internal innovation’ explained approximately 68% of ‘reactive and cost strategies’ variance. The regression coefficient of knowledge ‘cooperation with clients’ is 0.893, which means that when ‘cooperation with clients’ increases one unit, ‘reactive and cost strategies’ increases about 89.3% (confirmed H2), but when ‘personalisation’ increases 1%, ‘reactive and cost strategies’ decreases about 35.7%; and when ‘knowledge sharing’ increases 1%, ‘reactive and cost strategies’ decreases about 65%; and when ‘internal innovation’ increases 1%, ‘reactive and cost strategies’ decreases about 29.3%.

## Conclusions

This study focused on an analysis of the effects of knowledge, cooperation and innovation on internationalisation. As described above in the conceptual framework section, this study was based on one assumption made by several authors (e.g. Pinto et al. 2015; Rodríguez and Nieto 2012; Marques et al. [forthcoming](#)) that knowledge, cooperation and innovation have a positive impact on the internationalisation of firms, in the specific case of this study, which belong to the sector of KIBS.

A quantitative research methodology was used to test hypotheses based on a literature review and a research model that describes the relationships between internationalisation, knowledge, cooperation and innovation for Portuguese KIBS. On the one hand, our results show that knowledge personalisation has a positive influence on proactive strategies of internationalisation, such as external innovation and new organisation methods. When KIBS cooperate with clients, there is a positive impact on reactive and cost strategies of the internationalisation. On the other hand, reactive and cost strategies of internationalisation are negatively influenced by knowledge personalisation, knowledge sharing and internal innovation.

This research contributes to the study of KIBS in three ways: (1) to increase academic knowledge about this subject (2) to the management practice, allowing firms to gain insights that may develop their proactive strategies of internationalisation, specifically regarding the strategic management of knowledge and implementing model of innovation management involving clients and HEIs and (3) to reinforce the need for adjustment of public policies to encourage the development and strengthening of proactivity of this sector with regard to internationalisation and formal and informal networks.

A key limitation of this study relates to the reduced size of the sample. Collecting a larger sample would have benefited the research; however, the difficulty to access



information on KIBS firms in activity that have innovated in recent years has resulted in a smaller number of firms that were involved in R&D in recent years. This limitation is related to the definition of the object of study. In this study, the population would be too large, so, for practical reasons we had to limit the size of the sample. In view of this decision, the sample became very small, relative to population, also explained by the closing of some firms in the sample or a change in their contact. Another limitation relates to the fact that the dependent and independent variables were collected simultaneously, and from the same source.

In future paths of research, the sample could be increased so that the results can provide a clearer empirical view of how the variables included here relate and interact with other variables. Other causal links and explanations are plausible. For example, a positive correlation may exist between knowledge, cooperation, innovation and co-creation of innovation and localisation. Including location (rural versus urban), the size of firms, the different role of the actors of the development of local networks, and the characteristics of this business sector entrepreneurs could also be interesting for further investigation. In addition, a panel study of KIBS CEOs could be conducted to determine the depth of the present results. Finally, this study could be replicated in different countries using comparative analysis. These improvements and updates would strengthen knowledge on the co-creation of innovation, which can be incorporated within different strategies and interventions in the innovation processes of KIBS and other organisations. For instance, research into these other organisations (i.e. clients, HELs and other firms/institutions) could analyse more thoroughly the influence of KIBS on these organisations' innovation processes.

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