Understanding KIBS through their Differentiated Knowledge Bases: Applying and Extending a Conceptual Framework

Katia Pina  
University of Southampton - Southampton Business School  
Department of Strategy, Innovation and Entrepreneurship  
katia.oliveira-pina@soton.ac.uk

Bruce S. Tether  
University of Manchester  
Alliance Manchester Business School  
bruce.tether@manchester.ac.uk

Abstract

The focus of our research is knowledge intensive business services and particularly similarities and differences among these, at the levels of firms and industries. Knowledge has long held a central place in innovation studies, and in recent years Asheim and colleagues have developed a conceptualisation based on three different ‘knowledge-bases’, which go beyond the established distinction between ‘tacit’ and ‘codified’ knowledge. Very few studies have however either applied this conceptualisation at the firm level, or asked whether other ‘types of knowledge’ exist and can be identified. This paper addresses this by identifying a hitherto unrecognised ‘knowledge base’: compliance knowledge.

By bringing together the literature on KIBS and the literature on ‘knowledge bases’, this paper claims to make two contributions. First, it develops a novel conceptual understanding of KIBS firms through their differentiated knowledge bases. Second, it develops the conceptualisation of knowledge bases, particularly through the identification of a hitherto unrecognised ‘knowledge base’: compliance knowledge.
Understanding KIBS through their Differentiated Knowledge Bases: Applying and Extending a Conceptual Framework

Abstract
The focus of our research is knowledge intensive business services and particularly similarities and differences among these, at the levels of firms and industries. Knowledge has long held a central place in innovation studies, and in recent years Asheim and colleagues have developed a conceptualisation based on three different ‘knowledge-bases’, which go beyond the established distinction between ‘tacit’ and ‘codified’ knowledge. Very few studies have however either applied this conceptualisation at the firm level, or asked whether other ‘types of knowledge’ exist and can be identified. This paper addresses this by identifying a hitherto unrecognised ‘knowledge base’: compliance knowledge.

By bringing together the literature on KIBS and the literature on ‘knowledge bases’, this paper claims to make two contributions. First, it develops a novel conceptual understanding of KIBS firms through their differentiated knowledge bases. Second, it develops the conceptualisation of knowledge bases, particularly through the identification of a hitherto unrecognised ‘knowledge base’: compliance knowledge.

Keywords: knowledge bases, compliance knowledge, knowledge intensive business services.
**Introduction**

Knowledge-Intensive Business Services (KIBS), including Professional Service Firms (PSFs) have become highly significant in advanced knowledge economies. Their rapid growth has motivated research on these firms and sectors, including research that has reconsidered some of its most widespread assumptions concerning the structures, strategies and behaviours of firms.

KIBS have received considerable attention from academics (e.g., Bessant and Rush, 1995, Miles et al., 1995, Howells, 2006; Tether and Tajar, 2008; Shearmur & Doloreux, 2015; Herstad & Ebersberger, 2014; Giotopoulos, 2014) and policymakers (e.g., European Commission, 2009; United Nations, 2011; BIS, 2012; OECD, 2012; Schricke et al., 2012) who have sought to understand how these firms behave, compete and innovate. However, despite the growing upsurge of KIBS research, the majority of studies have considered these firms as a homogeneous group – especially in terms of ‘knowledge’ – and has focused on comparing these firms with product-based ones. While few studies have advocated and explored variety among KIBS (von Nordenflycht, 2010, Malhotra and Morris, 2009, Tether et al., 2012, Consoli and Elche-Hortelano, 2010; Corrocher et al., 2013), still, relatively little is known about what differentiates these firms and how variation among KIBS can be measured and understood.

Knowledge is clearly at the core of knowledge intensive firms, but knowledge may also be what differentiates them. Specifically, in this paper, we argue that KIBS vary in their knowledge bases. That is, they vary in the nature of the knowledge at the core of their activities, and moreover that this variation is meaningful for understanding the structures and behaviours of these firms. Among various proposed taxonomies of knowledge, we select the ‘knowledge bases’ typology advanced by Asheim and colleagues (Asheim and Gertler, 2005; Asheim et al., 2007; Asheim and Hansen, 2009; Asheim et al., 2011). This perspective differentiates activities by the ‘type’ or ‘form’ of knowledge, where knowledge is both cognitive and enacted, and involves different combinations of tacit and codified knowledge (Polanyi, 1966). Each ‘knowledge base’ therefore has different requirements in terms of qualifications and skills.

KIBS represent an ideal context in which to study ‘knowledge-bases’ because these firms are by definition knowledge-intensive, as opposed to being capital- or labour-intensive and knowledge is therefore at the core of their activities. Knowledge is not, however,
undifferentiated, and in this paper we argue that KIBS vary substantially in their knowledge-bases (Strambach, 2008; Consoli and Elche-Hortelano, 2010; Tether et al., 2012; Consoli and Elche, 2013). The identification and acceptance of ‘knowledge-bases’ or ‘types’ raises a number of questions, including what are they, how many are they, and what is the relationship between them. This paper aims to advance this stream of work further by understanding knowledge-bases that are being developed and exploited by ‘knowledge-intensive business service’ (KIBS) firms.

To develop this argument, the paper first elaborates on the relationship between knowledge intensive business services and knowledge bases, especially with reference to Pavitt (1984) and Malerba’s (2002, 2004) seminal contribution on sectoral differentiation and knowledge types. Subsequently, we introduce Asheim and colleagues typology of knowledge bases which differentiates between analytical, synthetic and symbolic knowledge. In this section we review the conceptual basis for understanding ‘knowledge-bases’. The third section offers a new insight on the existing knowledge typology with the introduction of a hitherto unrecognised knowledge-base – ‘compliance knowledge’ – based on the knowledge of laws and regulations. In this section we provide an overview of what compliance knowledge is with regards to its purpose for knowledge creation, inputs, approach, outputs, means of sharing, diffusing and retaining knowledge. Finally, our paper concludes by presenting compliance knowledge as especially relevant for the study and understanding of KIBS.
Conceptual Background

Knowledge intensive business services (KIBS)

“KIBS firms play an important role in national innovation systems, through original innovations, [and] knowledge diffusion. ... KIBS are a driver of ... services innovation and an essential element of regional and national innovation systems.”

European Commission, 2009

European and other advanced economies are increasingly knowledge-based. This has led to the substantial growth in business and other organisations that specialise in the development, supply and implementation of knowledge. These have been dubbed ‘Knowledge Intensive Service Activities’ (OECD, 2006). Some knowledge intensive services are provided to consumers, household, and governments, others are provided by businesses to other businesses (i.e., B2B). The latter are, or approximate to, ‘Knowledge Intensive Business Services’, or KIBS, which were identified in the mid-1990s by Ian Miles and colleagues (Miles et al., 1995) and include, among others, management consultancy, legal services, accounting and related services, computer software, architectural and engineering consultancy, advertising and market research.

The substantial upsurge of studies focused on these firms’ context, allows the collection of several main features that together classify and differentiate KIBS from non-KIBS firms. Amongst the most widespread, we highlight the following:

- **Knowledge intensity.** KIBS are known by their highly qualified professionals and the intellectually challenging nature of work (Hu et al., 2013; Corrocher et al., 2009; von Nordenflycht, 2007; Hitt et al., 2006);

- **KIBS as providers of business services** to other organisations, instead of directly to individuals or clients (Miles et al., 1995);

- **KIBS knowledge as both the input, the process and the output,** where there is an inseparability between the development of the solution ("product") and the nature of the solution (Tseng et al., 2011; Kipping and Kirkpatrick, 2013);

---

2 Here we say “approximate to”, because there is no agreed upon definition of KIBS. However, the definition of KIBS tends to excludes knowledge intensive services to consumers, such as health and education services, and services to governments, such as (secret) intelligence services.
• **Client and context specific.** KIBS are highly tailored and problem-oriented (Aarikka-Stenroos and Jaakkola, 2012; Greenwood et al., 2005; Bratani and Ragot, 1996; Chatain, 2010) which naturally involves a closer proximity between the client and the firm (Amara et al., 2009; Freel, 2006; Leiponen, 2006; Doloreux and Shearmur, 2013).

• **Intangibility** of the output. KIBS are known specially for providing intangible solutions to their clients (e.g. legal advice) (Criscuolo et al., 2007; Ritala et al., 2013; Biege et al., 2013; Hu et al., 2013), which does not mean that tangible solutions aren’t also developed (e.g. prototypes from architecture practices);

• **Professionalism** of some KIBS, such as accountancy and law firms (von Nordenflycht, 2007) which is intrinsically related to the fact that these firms (‘professional service firms’) (i) need to act at all times in the full interest of the client; and (ii) are certified by another professional body (besides the company to which they belong) to whom they need to answer for.

Overall, demand for KIBS activities has been growing (Dachs, 2009), due to the need for increasingly specialised expertise, plus reduced transaction costs (associated with advanced telecommunications) and the advantages of ‘outsourcing’ rather than ‘insourcing’ expertise in ‘make or buy’ decisions. Client firms are known to look to KIBS to help them innovate (Miles et al, 1995; Tether and Tajar 2008), in increasingly ‘open’ and distributed innovation processes (Chesbrough, 2003; Coombs et al., 2003).

The growth of KIBS, and services more generally, is also reflected in the transformation of innovation studies. For a long time, innovation studies focused on science and technological innovation (STI), primarily in relation to ‘hard technologies’ and tangible products, primarily produced by manufacturing industries (Miles et al, 1995). Only relatively recently have services (Miles, 2005) and less technologically oriented industries (von Tunzelmann and Acha, 2005) received the attention that their substantial economic significance and growth warrants. In the past 20 years or so, researchers and policymakers have dedicated substantial effort to understanding these industries (e.g. Barras, 1986; Barras, 1989; Gallouj and Weinstein, 1997), among which KIBS have received disproportionate attention. Following these efforts, KIBS have become recognised as being important players in innovation systems, as the quotation above from the European Commission testifies (c.f., Muller and Doloreux, 2007).
From differentiating sectors and regions by knowledge bases

Inputs from Pavit and Malerba’s work on Sectoral Systems of Innovation

Knowledge has a central role in the literature of innovation, and innovation systems (e.g., Pavitt, 1984; Cohen and Levinthal, 1990; March, 1991; Lundvall, 1993; Edquist, 1997; Teece et al., 1997; Malerba, 2002, 2005; Leiponen and Helfat, 2010), and in recent years scholars have conceptualised different ‘knowledge-bases’, or types of knowledge (e.g., Asheim & Gertler, 2005; Jensen et al., 2007).

Within innovation studies there has long been an appreciation that there are different ‘types’ of knowledge, and that these are related to different activities and approaches to innovation. A seminal contribution in this vein is Pavitt’s taxonomy (1984). Indeed, this has become one of the most cited works in the field of innovation studies.\(^3\) Pavitt was critical of two things which inspired his taxonomy. First, he had noticed that economic models (and especially macro-economic models) considered the production of technology and innovation to be exogenous whereas he considered it endogenous to economic development. Economic models also paid no attention to the variety of sources, and uses of innovations. Second, he was critical of the idea of a general pool or stock of knowledge, arguing that it missed the differentiated and firm specific nature of ‘industrial technology’.\(^4\) In developing the taxonomy, his objective was to try to explain similarities and differences among sectors in the sources, nature and impact of innovations. These were defined especially by the sources of knowledge inputs, by the size and principal lines of activity of innovating firms, and by the sectors of the innovations’ production and main use (Pavitt, 1984, p. 343). Therefore the aim of his ‘taxonomy’ was to start building systematically a body of knowledge - including data and theory - that encompasses the production of technologies and innovations, and which reflected sectoral diversity.

Pavitt’s taxonomy is ostensibly based on a dataset of about 2000 significant (technological) innovations introduced in Britain between 1945 and 1979, but this dataset of innovations was subject to ‘exploratory’ (p. 372) statistical manipulations; it was not – as Pavitt himself recognised - subject to substantial statistical testing (Peneder, 2003). For

---

\(^3\) To date, it has gathered over 6,000 citations, according to Google Scholar,

\(^4\) In this he was partially inspired by the work of Joan Woodward and her classification of modes of production, stating that while its purpose was different, his taxonomy was “in the same spirit” (p. 355). With regard to firms commitments to innovation, he asserted that “The purpose of [a firm’s expenditure on R&D and innovation] is to mobilise skills, knowledge and procedures in the firm in order to commercialise specific products and production processes, with the characteristics of operation, reliability and cost that satisfy user needs” (p. 348).
example, no statistical testing such as cluster analysis was undertaken to ensure the categories identified were statistically robust. Instead, Pavitt essentially inferred or induced the patterns by “allowing the patterns of statistical data to be compared to the mind’s eye with the rich range of sectoral and firm studies of technical change that have accumulated over the past 25 years” (p. 345).

For Pavitt, two central characteristics emerged from his analysis of the data. First, most of the knowledge applied by firms in innovations is not general purpose and easily transmitted and reproduced, but is instead appropriate for specific applications and is appropriated by specific firms. This recalls the ideas of codified and tacit knowledge (Polanyi, 1966), and of ‘sticky knowledge’ (von Hippel, 1986), but Pavitt did not use those concepts explicitly. Second, despite variation among sectors, including in the relative importance of product and process innovations, in the sources of technology and in the size and patterns of diversification of firms, common patterns were observable in terms of sources of technology, users’ needs, and means of appropriating benefits. Through these observations, Pavitt grouped activities into three categories, or ‘modes of innovation’ (Hollenstein, 2003; Jensen et al., 2007; Tether and Tajar, 2008) which he labelled ‘supplier dominated’, ‘production intensive’ and ‘science based’. The key features of the taxonomy are laid out in Table 5 of his work (Pavitt, 1984, p. 354) with ‘production intensive’ activities subdivided into ‘scale intensive’ and ‘specialist supplier’ activities.

As mentioned, Pavitt’s taxonomy has been widely influential in innovation studies. Particularly relevant is the fact that it places emphasis on differences among activities, underpinned by differences in knowledge, rather than emphasising homogeneity. Indeed, we can draw a parallel between Pavitt’s objective and our own. Pavitt’s objective was to try to “explain similarities and differences among sectors in the sources, nature and impact of innovations, defined especially by the sources of knowledge inputs, by the size and principal lines of activity of innovating firms, and by the sectors of innovations’ production and main use” (Pavitt, 1984, p. 343). Our interest is more confined to KIBS but nonetheless focuses on differences in knowledge, or types of knowledge. By substituting the word ‘knowledge’ for ‘innovation(s)’ we can outline our objective as trying to explain similarities and differences among knowledge intensive business services in relation to the sources, nature and impact of different ‘types of knowledge’.
Although highly influential, there are some controversies and limitations to Pavitt’s taxonomy, some of which he highlighted himself, with others being identified by Archibugi (2001). Key limitations recognised by Pavitt were that the taxonomy is static, not dynamic. Nor did he regard it as complete. He was open to the idea that new categories could develop or be identified. In the original paper, he states that it “needs to be modified and extended” (Pavitt, 1984, p. 370), and in a later work (Pavitt, 1990), he identified ‘information-intensive’ activities as an additional ‘sector’.\(^5\) Despite this, few scholars in the 30 years since its publication have sought to add to, or fundamentally question, the categories in the taxonomy.

A recent contribution which elaborates further this taxonomy is that by Castellacci (2008), who identifies three sectoral categories each of which are sub-divided in two. These are shown in Table 1 below. It is notable that despite a quarter of a century passing, three of Pavitt’s categories remain, with the three other categories having previously been identified by Soete and Miozzo (1989) in their ‘translation’ of the Pavitt taxonomy from manufacturing to services. It would appear, therefore, to have withstood the test of time. Pavitt’s taxonomy is influential partially because it brings together activities from different parts of the standard industrial classification, such as chemicals and electronics (as ‘science based’), and instruments and mechanical engineering (as ‘specialist suppliers’) on the basis that these share similar characteristics in terms of how they innovate, and how innovation is organised.

\(^5\) In the same work he argued that the category of ‘specialist suppliers’ was disappearing.
Table 1. Sectoral Categories identified by Castellacci, 2008

<table>
<thead>
<tr>
<th>Sectoral Category</th>
<th>Sub-Group within Each Category</th>
<th>Typical Core Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Knowledge Providers</td>
<td>Knowledge Intensive Business Services</td>
<td>Software, R&amp;D, engineering consultancy</td>
</tr>
<tr>
<td></td>
<td>Specialised Suppliers Manufacturing</td>
<td>Machinery, instruments</td>
</tr>
<tr>
<td>Mass Production Goods</td>
<td>Science-based manufacturing</td>
<td>Electronics</td>
</tr>
<tr>
<td></td>
<td>Scale-intensive manufacturing</td>
<td>Motor vehicles</td>
</tr>
<tr>
<td>Supporting Infrastructure Services</td>
<td>Network infrastructure services</td>
<td>Telecommunications, finance</td>
</tr>
<tr>
<td></td>
<td>Physical infrastructure services</td>
<td>Transport, wholesale, trade</td>
</tr>
</tbody>
</table>

Source: Castellacci, 2008, Table 1 (p. 984)

However, this is also a controversial aspect. Archibugi (2001) considers that the grouping should ideally be made at the level of the firm, rather than at the level of industries. He states, this is “a major limitation, since it is well known that firms which have for convenience been grouped together into an industry on the basis of their main output may have a very different technological base: both slippers and moon-boots belong to the footwear industry, but the technological-intensity of the two products is very different and it is reasonable to expect that their manufacturers will use different sources to innovate” (Archibugi, 2001, p. 419). In other words, the construct of an ‘industry’ is brought into question: firms within an industry are heterogeneous, not homogeneous; thus, “not all chemical firms deserve to be labelled as “science based” (Archibugi, 2001, p. 420). An alternative way of seeing this is to consider that there are various ‘modes of innovation’, which are more or less prominent in different sectors, but which do not exhibit a one to one mapping between modes and sectors (Tether and Tajar, 2008). Such an approach separates what is produced (e.g., chemicals products), from how these are produced or innovated (e.g. through ‘science-based’ R&D).

Archibugi (2001) further observes that some firms are multi-technology and multi-product, which makes them difficult to classify according to a single industry, and therefore difficult to fit into Pavitt’s taxonomy, because multi-technology and multi-product firms could simultaneously be in more than one of the categories (e.g., being simultaneously ‘science based’ and ‘scale intensive’). Again, if a technology-based classification is needed, it

---

6 Notably, while Pavitt’s focus is on ‘sectoral patterns of technical change’, he states in his paper that in the proposed taxonomy and theory the basic unit of analysis is the innovating firm (p. 353).
would be better if it were independent of other criteria, such as industry, or the extent to which a firm is diversified. In other words, it should be possible for firms and industries to exhibit multiple ‘modes of innovation’, albeit to different degrees. The same is therefore true of a ‘knowledge based’ conceptualisation, which we develop in this paper.

While taking inspiration from the Pavitt taxonomy, we do not apply it directly in our research for three reasons. First because the original taxonomy was developed on the basis of technical innovations embodied into products and, to a lesser extent, processes. As a consequence of this, the taxonomy has a strong orientation to manufacturing activities, and is less applicable to services, although attempts have been made to adapt it to services (e.g. Evangelista, 2000; Soete and Miozzo, 1989; Castellacci, 2008). Secondly because it considers functional technologies, such as new drugs, instruments and machines: it does not consider aesthetic innovations. Therefore, it considers the ‘sources of knowledge’ that generate essentially functional products (or rather products primarily categorised by functionality), while ignoring the sources of aesthetic or symbolic knowledge. Third because, our focus is not on innovations per se, but rather on the knowledge bases of firms, and knowledge-intensive business service firms in particular.

The ‘systems of innovation’ concept (Lundvall, 1992; Nelson, 1993), which became highly influential in the 1990s, built on the idea that innovation happens differently in different contexts, be they countries, regions or industries. In relation to industries or ‘sectors’, Malerba (2002; 2004) built on the idea that these differ in their approaches to innovation.

According to Malerba (2005, p. 385), “a sector is a set of activities that are unified by some linked product groups for a given or emerging demand, and which share some common knowledge. Firms in a sector have some commonalities, and at the same time are heterogeneous”. Malerba’s interest is in the relationship between a sector’s knowledge base and the way in which it is organised and innovates. In particular, he proposes that ‘sectoral systems’ have specific knowledge bases and that understanding the characteristics of these is crucial to understanding and explaining a sector’s structure, actors and dynamics, including innovation and learning processes.

Malerba’s (2004) conceptualisation of innovation in sectors is grounded on four main principles. First, that sectors are not stable entities, but change and transform over time. Second, that activities and resources among different sectors are interdependent, and their
links and complementarities influence positively the sector’s growth and innovation performance. Third, that innovation is a collective process and therefore interaction among different actors (e.g. people, firms, research institutes, universities, government, etc.) will benefit the overall learning process and therefore innovation outcomes. Lastly, that learning and knowledge are central to economic systems and that sectors will have specific but at the same time heterogeneous competencies, knowledge bases and experience. Ultimately, Malerba differentiates sectors according to their knowledge base and technology, actors and networks, and institutions. In relation to the former (c.f., Malerba and Orsenigo, 2000), he argues that knowledge bases differ in their accessibility, which is related to the extent of codification and opportunities to access to external knowledge; in cumulativeness, the extent to which new knowledge builds on prior knowledge and is therefore ‘path dependent’; and opportunity, in terms of what is unknown relative to what is known, and demand for new knowledge. However, unlike Pavitt or Asheim (whose perspective we discuss below), he does not identify any ‘ideal types’ of knowledge bases, but rather emphasises that a sector’s knowledge base can be heterogeneous in terms of the extent to which it draws on different scientific and technological fields.

As with Pavitt’s taxonomy, Malerba’s ‘sectoral systems’ perspective is helpful to our work because it places emphasis on differences rather than homogeneity. However, two criticisms of Pavitt also apply to ‘sectoral systems’. The first is that this work has tended to focus on product-based industries, and especially manufacturing. The concept of a ‘sector’ is arguably much less clearly defined in services than in manufacturing (Tether and Metcalfe, 2003). Do, for example, advertising and market research belong to the same sector, or are they different sectors? Similarly with architecture and engineering consulting, which may be considered different sectors, in the same sector, or sub-sectors within the wider ‘construction sector’. Secondly, the conceptualisation of knowledge bases is arguably under-developed, with an emphasis on scientific and technological, or functional, knowledge. Aesthetic and symbolic knowledge is for example absent, as is knowledge of regulations and laws, despite often being important in sectoral systems. With our paper, we do not seek to develop a fully-fledged ‘sectoral systems’ perspective, but rather seek to better understand the knowledge bases being applied by ‘knowledge intensive business services’, including by looking for commonalities across as well as within sectors. Further work, for example on the institutional arrangements would be needed to fully develop a ‘sectoral systems’ perspective in relation to these activities.
In parallel with the interest in ‘sectoral systems’ of innovation, and drawing essentially from the same intellectual roots, researchers have focused on ‘regional innovation systems’; these scholars have been interested in the geography of innovation, and how the nature and organisation of innovation varies between regions. Among these are Bjorn Asheim and his colleagues, who have placed emphasis on different ‘knowledge bases’. While our work does not concern the geography of innovation in a substantial way, we share Asheim and colleagues’ interest in ‘knowledge bases’. With respect to this, it is interesting to review how this literature and conceptualisation has developed over time.

**Differentiated knowledge bases**

Knowledge is considered to be a, if not the, key resource which underlies the current and future advantage of the firm (Grant, 1996; Kogut & Zander, 1992), but it is often presented as an undifferentiated stock concept. That there are different ‘types of knowledge’, and that these are associated with differences in firm behaviour, including innovation behaviours, is widely accepted in innovation studies (Pavitt, 1984; Malerba, 2002; Jensen et al., 2007; Castellacci, 2008). As discussed above, Pavitt’s (1984) seminal taxonomy of sectors distinguishes between different approaches to innovation which are based on, inter alia, different sources of, and approaches to, knowledge development, while Malerba (2002; 2004) argues that one of the fundamental reasons why sectors differ is that their knowledge bases vary.

Asheim and colleagues (2005; 2006) joined this theoretical discussion with the introduction of a ‘knowledge bases’ conceptualisation, which places emphasis on different ‘types’ of knowledge, or qualitative differences in what is known and how. The ‘knowledge bases’ approach represents an action-based conceptualisation (Cook and Brown, 1999), which relates to how knowledge is developed, adapted and applied in economically relevant ways. While several taxonomies of knowledge have been proposed (Kakabadse et al., 2003), Asheim and colleagues’ (Asheim & Gertler, 2005; Asheim & Coenen, 2006; Asheim and Hansen, 2009; Asheim et al., 2007, 2011) epistemological classification goes beyond Polanyi’s (1967) seminal distinction between tacit and codified knowledge. Specifically, Asheim and colleagues have identified three ‘knowledge-bases’: synthetic, analytical and symbolic. We outline each of these below, but in general terms this conceptualisation reflects
the different ways in which knowledge is generated and applied, and how this relates to firms’ innovation capabilities. Put differently, it identifies the approaches to how, and the principles of reasoning through which, knowledge is developed, including the criteria for evaluating the value and usefulness of the knowledge (Manniche, 2012). Importantly, activities undertaken will vary and key activities are therefore signifiers, or observable reflections, of the knowledge-bases. Thus, the activities of a firm will reflect its knowledge-bases, with the most prominent activities reflecting the most prominent knowledge bases. We now briefly review the main characteristics of the three knowledge-bases already identified by Asheim and colleagues.

**Analytical, synthetic and symbolic knowledge bases**

Originally, Asheim and colleagues included only two types of knowledge: analytical (or “science-based”) and synthetic (or “engineering-based”) knowledge (Asheim and Gertler, 2005). Later, they added a third type – symbolic knowledge, which is “arts-based”. This typology incorporates different combinations of tacit and codified knowledge and reflects different rationales for knowledge creation, which also relate to differences in learning and innovation processes (Martin, 2013). Moreover the typology seeks to acknowledge diversity of industries, regions and occupational structures and to encompass variety among people’s skills and academic backgrounds that are influential in the creation of different types, or forms, of knowledge (Asheim and Hansen, 2009).

Specifically, ‘analytical’ knowledge relates to economic activities that are underpinned by scientific understandings that are themselves based on cognitive and formalised models, especially with a logical or deductive basis (Asheim, 2008; Asheim and Hansen, 2009). The main purpose of these (know-why) scientific understandings is to understand and explain features of the natural and social world (Manniche, 2012). In general, analytical outputs tend to be codified and formally documented, and are therefore easy to transfer (but not necessarily easy to interpret or understand). They are understood among communities that may be spatially dispersed but that share the ‘same language’ and are therefore able to read and understand the codified documentation and information (Asheim et al., 2011; Asheim and Hansen, 2009).

People involved in the development of this type of knowledge need to have and develop specific skills and qualifications – i.e. abstraction, analytical capabilities, theory building and
testing – often associated with research experience. The activities that lead to the development and use of analytical knowledge can result in scientific discoveries or the development of significantly new products and processes (Asheim et al., 2011). Companies with an analytical knowledge base are the most likely to have their own R&D departments (Asheim, 2008), however, while analytical knowledge requires an understanding of the application of scientific methods this does not necessarily imply a need to further develop these methods. For example, a market research company might undertake surveys and subject these to a set of statistical methods and tests, without seeking to advance statistical science.

‘Synthetic’ knowledge is, by contrast, characterised by being related to activities that are developed with the aim of solving specific problems. It is therefore more oriented to ‘know-how’, resolving practical problems and providing solutions (Manniche, 2012; Martin, 2013). Asheim and colleagues frequently refer to this as “engineering-based” knowledge. Solutions are often generated in collaboration with customers and suppliers (Asheim et al., 2011; Asheim and Hansen, 2009), and consequently, the outputs are frequently ‘one off’ and bespoke, or produced in very small quantities. When compared with the analytical knowledge, this type is fundamentally more practical and essentially pragmatic; it is less reliant on scientific methods, including logical deduction, and more reliant on ‘know how’.

Practical work and interactions are central to the development and use of synthetic knowledge (Asheim et al., 2011). Indeed, synthetic knowledge tends to result from practical testing and experimentation, plus experience gained addressing similar problems, and through leveraging ongoing learning by doing, using and interacting (c.f., Jensen et al., 2007). Professional training and especially experience are therefore central to the development of ‘synthetic knowledge’.

Asheim observes that firms based on “synthetic knowledge” do not usually have R&D departments (Asheim, 2007). Although the knowledge developed through these activities can also be consolidated into databases or manuals, often it is not, and is instead maintained in the minds of practitioners. ‘Synthetic knowledge’ requires skills related to on-site problem solving, including localised ingenuity and bricolage (Baker and Nelson, 2005): these skills may be grounded in one or more academic disciplines, but vocational training and learning through experience are more prominent. The applied orientation of synthetic knowledge means that it is usually developed at sites of application (Moodysson et al., 2008).
While more fully elaborated, the distinction between the ‘analytical’ and ‘synthetic’ knowledge bases made by Asheim and colleagues is not highly innovative, as close parallels can be identified in existing innovation studies literature (e.g., Pavitt, 1984; Gibbons et al., 1994; Jensen et al., 2007). For example, these “knowledge-bases” are similar to the two modes of knowledge production identified by Gibbons et al. (1994): Mode 1 being concerned with the production of scientific knowledge, whereas Mode 2 is concerned with providing solutions. And arguably a similar conceptualisation is provided by Jensen et al., (2007), who distinguish between two modes of innovation and learning: one based on ‘Science, Technology and Innovation’ (STI); and the other based on ‘Doing, Using and Interacting’ (DUI). The former relies on codified, scientific and technical knowledge; the latter on more ‘everyday’ sources of knowledge, including tacit knowledge (Jensen et al. 2007, Johnson et al. 2003). As with Asheim’s types, these modes essentially differ in terms of their learning processes, knowledge sources and knowledge development methods.

Within the domain of innovation studies, including studies on regional innovation systems, the original contribution of Asheim and colleagues work on ‘knowledge bases’ lies primarily in their identification of, and acceptance of, a third ‘type of knowledge’: ‘symbolic knowledge’. Innovation studies has paid perhaps surprisingly little attention to symbols, including product design, aesthetics and styling (for an exception, see Cappetta et al., 2006). By contrast, economic geographers including Michael Storper and Alan Scott (2009) have highlighted the importance of artistic creativity, and “buzz”, and as an economic geographer also active in the innovation community it is perhaps unsurprising that Asheim brought these ideas into innovation studies.

According to Asheim and colleagues, ‘symbolic knowledge’ is “arts based”; it is related to artistic expression and to the creation of desire and meanings. It has a strong orientation to the visual features of products and solutions through images, symbols and cultural objects (Asheim and Hansen, 2009; Martin, 2013). The growth of media, advertising and fashion industries reflects the growing importance of this type of knowledge. In this digital era where services are becoming more sensitive and experience-based, symbolic knowledge is also becoming increasingly important (Scott, 2007). This type of knowledge relies strongly on the creation of expressive ideas and concepts, and is based on capabilities related to insight, imagination, inspiration and intuition. The knowledge produced is typically highly context specific, tacit and talent-based. The process of development, use and diffusion
of symbolic knowledge occurs through creative stages and socialisation – with collaboration frequently being a key dimension (Asheim et al., 2011).

Furthermore, the process of production in firms with a symbolic knowledge base is normally organised on the basis of temporary projects that often mix people with different skills and (academic) backgrounds (Asheim, 2007; Asheim and Hansen, 2009; Martin, 2013). Individuals work in temporary teams which work closely together during the project, after which the team is disbanded (Martin, 2013). Knowledge is here exchanged between different individuals who share and further develop a common view and interpretation of the product or solution’s properties. This like-minded group of individuals, who share the same understanding and cultural meaning of the final product, have been termed an ‘interpretative community’ by Fish (1980). Members normally share the same interpretation and strategies to achieve a specific result and are aligned on the aesthetic properties of the solution.

The three ‘knowledge bases’ identified by Asheim and colleagues are defined as ‘ideal types’ (Asheim and Hansen, 2009, p.431), which, conceptually at least, means that they can co-exist (to different degrees) in regions, industries and organisations. The extent to which a knowledge base exists or is dominant will vary according to the characteristics of the entities and their specific activities. Interestingly however, the vast majority of studies that apply the ‘knowledge bases’ conceptualisation do so at a relatively high levels of aggregation, such as at the regional, industrial or systems levels (e.g. regional innovation systems), rather than at the level of firms, or activities within firms. Furthermore, a considerable number of studies tend to focus on the identification of a single (or dominant) knowledge base in each industry or region, thereby assuming a ‘one to one’ mapping of knowledge bases to contexts. Indeed, only very occasionally are multiple knowledge bases considered to co-exist in different industries, regions or firms. Occasionally, industries are considered to draw on more than one knowledge base. This points to difficulties in considering units of analysis, and especially larger, more heterogeneous units such as industries or regions and considering these as having a homogeneous knowledge base.

Also apparent is that: (i) researchers have overwhelmingly relied on the knowledge types identified by Asheim and colleagues, accepting their nature and not questioning the constructs. Furthermore, nobody has suggested any additional ‘types of knowledge’ beyond

---

7 e.g., Todtling et al., (2011) with respect to ICT, while another study splits the aerospace sector, considering aviation within this as drawing on ‘synthetic knowledge’ while space draws on ‘analytical knowledge’ (van Tuijl and Carvalho, 2014, p.1967).
the three now identified; (ii) there is a tendency to select extreme cases – for example, the analytical industries identified are those strongly oriented to science (e.g., biotechnology, nanotechnology, etc.), whereas the symbolic industries are strongly oriented to the arts (e.g. fashion). Intermediate cases are rarely considered (although ICT has proved difficult to classify); lastly, (iii) the great majority of studies are bases on case studies, including the same or similar industries. These tend to be technologically based and product oriented, while services, including ‘knowledge intensive services’, have been neglected. An exception is Pina and Tether’s (2016) study applied to UK firms in three KIBS sub-sectors (e.g. architecture and engineering consulting; specialist design and software and IT consulting). Utilising information drawn from company websites, Pina and Tether found that firms with different primary knowledge-bases are: 1. present in different industries (i.e., that there is not one-to-one mapping of knowledge bases to industries), 2. have different propensities to engage in various innovation related activities, and 3. have different propensities to innovate. These findings not only provide empirical support for Asheim and colleagues’ conceptualisation, but indicate that understanding the knowledge-bases aids understanding the heterogeneity of firms, and especially KIBS firms.

While Asheim and colleagues’ main conceptual innovation has been the addition of ‘symbolic knowledge’ as a third knowledge-base, there is no explicit claim that the conceptualisation is a complete typology. And if we accept that these knowledge-bases exist, this then begs the question whether there are other, hitherto unrecognised knowledge-bases, and how these can be identified conceptually (as ideal types) and empirically. Furthermore, as the number of identified knowledge-bases increases, the question of how these inter-relate also arises: are some for example more closely related to one another (Neffke and Henning, 2013). Another question is the extent to which knowledge-bases can co-exist within firms, or whether firms tend to specialise in one. Specialisation in one may enhance internal coordination by reducing internal communication costs and may be associated with a stronger sense of identity (Kogut and Zander, 1996). On the other hand, the desire to keep existing clients and win new ones may encourage firms to diversify into additional knowledge bases, weakening the connection between any primary knowledge base and the firm’s identity.

---

8 Kogut and Zander argue that what a firm chooses to do relates to its internal rules of coordination and processes of learning which are situated in their identify, which itself “implies a moral order as well as rules of exclusion, [and therefore] the assemblage of elements that compose an organization are subject to requirements of consistency; not all technically feasible complements are permissible within the logic of a shared identity” (Kogut and Zander, 1996, p. 515)
Having focused on KIBS, which, as we showed, the literature on which relies heavily on exploring legal and accounting firms, our intuition is that at least one further knowledge-base exist and can be distinguished. Specifically, we consider that a knowledge-base related to legal and regulatory ‘compliance’ exists, and that this is distinct from any of the three knowledge-bases hitherto identified.

Compliance Knowledge: A Fourth Knowledge Base?
The requirement to comply with laws and regulations (such as those related to employment law, or health and safety regulations) affects all industries, and many industries are also subject to specific regulations. For example, the construction industry is required to comply with building codes, while in the UK the advertising industry is regulated by the advertising standards authority. Some regulations are statutory, while others are inscribed into codes of conduct which industries or professions agree to. Thus compliance knowledge is widely required, and relates to both general regulations and to the industry specific understandings of laws, regulations and procedures. Not only is an understanding of laws and regulations important, but so is the ability to interpret and manipulate these: regulations are rarely entirely codified, and a distinction is often made between the ‘letter of the law’ and the ‘spirit of the law’.9

Some ‘compliance knowledge’, such as routine health and safety regulations including fire evacuation procedures for buildings, is widely diffused. Understanding these procedures does not require substantial specialist education or training. Other ‘compliance knowledge’ is, by contrast, much more specialised, and requires specialised education and training, most obviously a legal training, but many other professions also include the development of ‘compliance knowledge’. For example, accountants are required to understand and implement legitimate accounting procedures, while architects and building engineers are required to design and construct buildings in accordance with building codes. Medicine is also regulated, both legally and professionally; in the UK by the British Medical Association. Indeed, access to the classic professions is determined by the passing of exams, which, inter alia, test the candidate’s knowledge of the rules and regulations of the profession. Continuous professional development (CPD) training may also be a requirement of professionals to maintain their licence to practice. This CPD includes knowledge of the changing regulations of the

---

9 Note that this is particularly the case in common law countries, such as the UK and US, where judges as well as legislators make laws, through judgements which are themselves interpretations of laws and precedent.
profession. Thus compliance knowledge is central to most if not all formally recognised professions, including those that hold ‘chartered’ status. It is not the case, however, that specialised compliance knowledge is required to practice in all professional services: management consultants are, for example, unregulated; they are not obligated to be trained in compliance knowledge.

In this paper we recognise “compliance knowledge” as the knowledge base concerning the activities that aim to provide, assess and reformulate solutions that are required to comply with, or circumvent laws and/or regulations. It is our understanding that for compliance-based firms, R&D is generally unimportant; instead, links with training, certification bodies and related networks are significant. Knowledge inputs are typically at least partially controlled by the professional association that certifies professionals according to their expertise and which upholds the ethical code. Compliance knowledge is interpretative in the sense that it is based on accepted and documented interpretations of judicial judgements, laws and regulations, but it can also be assertive, in the sense that the professional may be effective at arguing for the stretching or reinterpretation of laws and regulations, and/or at exploiting inconsistencies in the corpus of regulations, including finding ‘loopholes’. This, for example, is the basis for the distinction between legal tax avoidance and illegal tax evasion. Compliance knowledge is developed through studying laws, norms and regulations and the principles underlying these; a solution is often developed in response to a specific client requirement. Compliance knowledge professions highlight their expertise and ‘trustworthiness’, and typically claim to operate to high ethical standards, which are upheld and enforced by professional associations. For example, in relation to legal firms, Cooper and colleagues argue they are more than a professional service firm, they are “a special kind of business, on which private accumulation is dependent on being seen to attend to the public interest and to apply expertise”, and where “there are professional standards and norms (typically articulated in ethical codes, socialization and rules of conduct)” (Cooper et al., 1996, p.629).

Compliance knowledge is therefore seen as ‘conformity with all requirements, not limited to legal requirements. This includes business best practices, standards for sustainability, operational activities, or self-imposed requirements to target customer types, etc.’ (Doyle et al., 2014, p. 1156). Table 2 summarises the characteristics of (and distinctions between) the four knowledge-bases considered in this paper, including the ‘synthetic’, ‘analytical’ and ‘symbolic’ identified by Asheim and colleagues and ‘compliance
knowledge’, which we identify as an additional, previously unrecognised, knowledge base. Overall, the knowledge-bases developed and deployed by a firm are likely to be a significant aspect of what differentiates them in terms of their internal and external organisation. In terms of internal organisation, for example, the nature of the knowledge-base relates to the extent to which knowledge is centralised or decentralised (Hansen et al., 1999; Lowendahl et al., 2001) and therefore the extent to which this core resource is under the direct control of the firm’s owners and managers, or is in the control of others, including non-managing directors or partners and other employees. In terms of external organisation, differences in knowledge-bases are likely to relate to the extent to which work is done in close proximity to, and indeed with, clients, as opposed to being undertaken more remotely, and for clients (Asheim and Gertler, 2005; Tether et al., 2012). Ultimately, differences in the knowledge-bases and their underlying processes are likely to be reflected in differences in the ways firms generate and use knowledge, including methods and processes.
Table 2. Summary of the main characteristics of the four differentiated ‘knowledge bases’

<table>
<thead>
<tr>
<th>Purpose of knowledge creation</th>
<th>Synthetic</th>
<th>Analytical</th>
<th>Symbolic</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designing and/or providing practical solutions to client specific problems.</td>
<td>Provide rigorous understanding of natural or social phenomena.</td>
<td>Creating and/or manipulating expressive forms to elicit desire and/or achieve distinction.</td>
<td>Providing, assessing or reforming solutions so that they comply with laws and regulations.</td>
<td></td>
</tr>
<tr>
<td>Identification of specific problems needing a practical solution.</td>
<td>Identification of a need for knowledge or information requiring rigorous, objective analysis.</td>
<td>Identification of a need or desire for distinctiveness through expressive language or forms.</td>
<td>Identification of a need to comply with, or circumvent laws and/or regulations.</td>
<td></td>
</tr>
<tr>
<td>Application of experience and heuristics developed through learning by doing, using and interacting, especially on similar prior projects. Inductive processes of trial and error, experimentation and practical work; Includes attending to ‘field problems’ (von Hippel, 1988), and solutions are pragmatic and may be “bricolaged”.</td>
<td>Application of legitimated scientific models and methods, usually grounded in mathematics and/or logic. Work follows deductive, rational processes with a strong orientation to objective findings. Requires an understanding of the application of scientific methods, but not necessarily oriented to further development of these.</td>
<td>Development of artefacts and expressive forms imbued with socio-cultural meanings, usually by means of generative and creative processes based on inductive and divergent thinking. Typically requires an appreciation of abstract symbolic languages and their socio-cultural meanings.</td>
<td>Application of knowledge and the likely interpretation of laws, regulations and required procedures to evaluate whether or not a proposal complies with these. Also offering advice to ensure a proposal is compliant. Requires formal (and of usually certified) knowledge of laws and regulations, and an ability to argue a case.</td>
<td></td>
</tr>
<tr>
<td>Type of knowledge created</td>
<td>Practical, based predominantly on intuition, experience without recourse to extensively documented materials.</td>
<td>Deterministic, based on scientific methods and codified data sources</td>
<td>Expressive, based on insight, subjective interpretation and conditioned by attitude to socio-cultural acceptance.</td>
<td>Interpretive, based on extensively documented knowledge and the certified expertise.</td>
</tr>
<tr>
<td>Importance of client interactions</td>
<td>Requires strong client interactions throughout the project.</td>
<td>Client specifies requirements but rarely directly involved in execution.</td>
<td>Client interactions primarily for approval and alignment.</td>
<td>Client presents case and information, and considers compliant solutions.</td>
</tr>
<tr>
<td>Means of sharing, diffusing and retaining knowledge</td>
<td>Knowledge held primarily in minds of those involved; shared through joint project experience.</td>
<td>Knowledge codified into publications, patents and software algorithms. Techniques diffuse through replication.</td>
<td>Signature styles associated with prominent individuals. Diffusion and learning through atelier methods. Successful forms liable to imitation.</td>
<td>Accepted and documented interpretations of judicial judgements, laws &amp; regulations. Lobbying and influencing regulatory bodies.</td>
</tr>
<tr>
<td>Outputs</td>
<td>Practical solutions, often including implementation. Written documentation is secondary.</td>
<td>Documented reports with findings. Guidance on how to use findings is secondary.</td>
<td>Creative symbols or forms, including graphics, models and prototypes.</td>
<td>Documented and/or verbal advice, sometimes with guidance for implementation.</td>
</tr>
<tr>
<td>Examples of outputs</td>
<td>Supply chain management, marketing &amp; business restructuring</td>
<td>Market research reports, investment analysis reports, structural analysis.</td>
<td>Brands, logos, distinctive product forms, iconic buildings.</td>
<td>Building regulations reports, health and safety compliance reports, etc.</td>
</tr>
</tbody>
</table>

*Inspired by Asheim & Coenen, 2005; Asheim & Hansen, 2009, Manniche & Testa, 2010; Asheim et al., 2011; Todtling et al., 2011; Manniche, 2012; Tether et al., 2012*
The knowledge bases of knowledge intensive business services

Up to now, the majority of studies on KIBS have emphasised what differentiates KIBS from product-based firms, focusing more on what these have in common and less on their heterogeneity (Kipping and Kirkpatrick, 2013; Corrocher et al., 2013; Tether, 2005; Greenwood et al., 2005). Notwithstanding the substantial attention dedicated to KIBS in the last three decades, very few studies have gone ‘from’ understanding what aggregates these firms together ‘to’ what are the specifics of each one of them (Malhotra and Morris, 2009; von Nordenflycht, 2010; Tether et al., 2012; Consoli and Elche-Hortelano, 2010). One reason for this may be the fact that most studies explore only a single sectoral context. Indeed, a systematic literature review on KIBS (and how they innovate and compete) has showed that very few studies develop comparative analysis among different sectors and that there is a tendency to privilege a small number of industries among others. For example, management consulting, legal practices and accounting and financial services are by far, the most studied sectors.

Therefore, while some industries are clearly heavily researched, findings of single industries (or of a small group of industries) are being generalised to the overall understanding of KIBS. This begs several questions: can what we know about legal and accounting firms, for example, be generalised to other KIBS firms such as architecture and design? Is the knowledge produced among market research, IT services, management consulting and advertising firms of the same nature? Are the knowledge inputs and sources the same? Are the skills and professional’s qualification among these KIBS’s firms similar? Are these firms dealing with the same challenges and producing similar types of solutions? As Suddaby and colleagues (2008), we believe there is still a need to explore the ‘significant and sometimes subtle differences between professions, professional workers and the way that PSFs are managed’ (p.990). Specifically, we argue that KIBS are heterogeneous in their knowledge bases.

Current literature lacks understanding on differences among KIBS (von Nordenflycht, 2010; Malhotra and Morris, 2009) and we contend that not only there is a need for more studies exploring these, but we also challenge the established knowledge. It is our understanding that a closer look into what these firms do and the type of knowledge produced would help understanding KIBS distinctive behaviour and structures. While our focus differs from that of Pavitt (innovation and technological trajectories), Malerba (sectoral systems) and
Asheim (regional innovation systems), we have drawn inspiration from each of their works. In keeping with all of these scholars, our research focuses on variety, and understanding variety. Our scope is different, and perhaps more limited, as we only consider knowledge intensive business service firms, whereas these scholars consider primarily technologically-based industries, and especially manufacturing. Like Asheim, we seek to include symbolic and other knowledge bases that extend beyond the technological and functional knowledge privileged by Pavitt and Malerba. In so doing, we also aim to add to the relatively limited work within innovation studies on services, and variety among services (e.g. Evangelista, 2000; Hollenstein, 2003; Castellacci, 2008 and Tether and Tajar, 2008).

Another difference is that our focus is on knowledge rather than innovation. We conjecture that variety among KIBS can be better understood by considering the knowledge central to their activities. While having knowledge intensity in common, we consider that qualitative differences in knowledge bases may be linked to differences in the way these firms behave, are organised and innovate. And, ultimately, it may be possible to ‘map’ the relationship between the type of ‘product’, means of production (e.g., tools used) and the organisation of production in KIBS as Woodward (1965; Davies and Frederiksen, 2010) did for manufacturing.

Bringing the knowledge bases literature, together with the knowledge intensive business services one, we aim to provide a new way of examining firms, and more specifically KIBS. The underlying knowledge of these, be it analytical, synthetic, symbolic, compliance or a mixed of two or more of these, determines the nature of the knowledge produced and the solutions provided to KIBS’ clients. Knowledge, as KIBS’ fundamental essence, provides useful inputs and may help in important management decisions. For example, which resources should be provided with a view to the development of a specific knowledge solution? Which skills and qualifications are required? How should knowledge professionals be managed in order to achieve their best (and aligned with the organisational goals) performance? Which external links (including with the client) should be developed and are worth investing in?

Understanding the different knowledge bases and reflecting on the main specificities of these, demands a closer analysis of firms. It demands that we move forward from the identification of KIBS as a ‘special’ group of firms, to an understanding of which KIBS are closer together by their type of knowledge. By doing this, we may be able to understand their
intrinsic mechanisms and structures, anticipating typical behaviours and the adequate performance strategies. Specifically, with a focus on KIBS, we identified four knowledge bases, three developed by Asheim and colleagues – analytical, synthetic and symbolic – and one developed in this paper – compliance. Table 2 has presented each knowledge base’s features and these should be analysed allowing for each firm’s (or industry) core business. Being able to analyse a firm considering their most central knowledge base(s) provides the lens to analyse firms under a specific set of characteristics that together both inform and justify firms’ differentiated structures. Typical ways of acting can be traced and examined with a view to specific goals; and specific behaviours can be classified and further predetermined based on where the firm wants to go.

Although we are well aware that firms are complex entities, the simplification of their analysis by considering KIBS under different ‘knowledge umbrellas’ of interrelated traits is useful to make sense of their numerous and heterogeneous characteristics. For example, let’s consider a situation where a KIBS firm is asked to produce a creative output that reflects client’s inner identity through the colours, shape, texture and style of a logo. Through the client’s request we can then question the nature of the knowledge solution being produced. Is the output expected to be developed through analytical reasoning or based on creative processes? Does it demands legitimated scientific methods or is it better developed through subjective, inductive and interpretative thinking? What kind of knowledge (-intensive) professionals could better develop the solution, highly analytical professionals with a strength in mathematics and/or logic or employees capable of abstract symbolic thinking and languages with a good knowledge of their socio-cultural meanings? These questions help us creating the boundaries of differentiation among KIBS and they gradually narrow down the alternatives of action related to these firms. With an analysis and respective answer to the above questions we are probably closer to classifying this firm as a symbolic-based KIBS which is coherent with a distinctive way of (i) organising their work and employees (e.g. through project based teams), (ii) managing their clients’ relationships (e.g. by keeping a close interaction for both data collection and continuous validation of the solution); (iii) managing and sharing their knowledge (e.g. through atelier methods), etc.

By bringing together both knowledge bases and KIBS literature we don’t expect to totally simplify the complexity of KIBS firms. However, we do believe that by classifying KIBS by their differentiated knowledge base reduces their complexity in the sense that it limits the spectrum as to what we should focus on. In essence, the nature of the activities core
to the business enlightens the processes, structures, challenges and skills associated with the firms. This should, however, be considered as ideal types. While firms may have a dominant knowledge base, different mixes of two or more will reflect new business essences.

**Conclusions**

KIBS are firms mostly known by being distinct among the following 5 main characteristics: (i) being ‘knowledge intensive’ (Hu et al., 2013); (ii) being ‘providers of business services’ to other organisations rather to individual ‘consumers’ (Consoli and Elche-Hortelano, 2010; Shearmur and Doloreux, 2009); (iii) having knowledge as an input, process and ‘product’ (Tseng et al., 2011; Kipping and Kirkpatrick, 2013). This implies a close inter-connection between the production process and the nature of the output; (iv) developing services that are context or client-specific (bespoke or tailored solutions) Bratani and Ragot, 1996; Greenwood et al., 2005); client relationships involving co-production and expert knowledge transfer (Criscuolo et al., 2007; Corrocher et al., 2009; Freel, 2006); and finally, (v) often producing intangible outputs (e.g. legal advice) (Greenwood et al., 2005; Criscuolo et al., 2007; Corrocher et al., 2009).

Also known as a typical characteristic of some KIBS firms is the fact that it is professionalised. This is true for some but not all KIBS. Examples of professionalised businesses are legal and accountancy firms (von Nordenflycht, 2007). This implies that firms always act in the full interest of their client. But also, that the individual responsible for the solution development has to answer to both the firm for whom the employer works for, but also to the legal or institutional entity which he belongs. For example, a professional body or a certificate entity. This specific characteristic, restricts firms’ freedom in what concerns the business in which they may be involved in as they need to comply with other groups’ conduct.

The previous characteristics reflect three decades of rich advancements in the literature of KIBS. Specially with a focus on what KIBS firms have in common, current research is consensual on what differentiates these firms from the product- or technology-based ones. However, while the majority of scholars developing work on KIBS have focused on confirming these firms’ most accepted features, the discussion has quite essentially considered KIBS as an homogeneous group and much less is known about what differentiates
them (Tether et al., 2012; von Nordenflycht, 2010; Malhotra and Morris, 2009). The diversity of intra-industries characteristics is rarely considered and therefore there is surprisingly little information on KIBS heterogeneity. A few exceptions include Miles and colleagues (1995) who have distinguished between p-KIBS (professional-based KIBS) and t-KIBS (technology-based KIBS); Lowendahl (2005) who have distinguished between centralised and decentralised firms; and von Nordenflycht (2010) who proposed a taxonomy to distinguish among different professional service firms.

The knowledge bases approach represents one way of understanding these firms’ diversity by looking at the nature of their knowledge. In this paper, we made two main contributions. First, we contribute to understanding differentiation among KIBS by considering their knowledge base(s), which are at the heart of their activities and at the core of their value propositions. Second, we develop the conceptualisation of knowledge bases, particularly through the identification of a hitherto unrecognised ‘knowledge base’: compliance knowledge. This knowledge base is related to understanding and manipulation of laws and regulations and is widely required. While looking at KIBS firms – and especially when a large number of studies focus on law and accounting firms – it became clear that another knowledge base existed, was relevant, but neglected. By identifying this fourth knowledge base this paper contributes to the knowledge bases model.

By better understanding the knowledge-bases being developed and applied by KIBS firms, we conjecture that we can better understand their internal and external organisation, and evolution. The next steps would benefit from the development of measures to classify firms according to their knowledge bases and then examining how knowledge bases relate to the characteristics of the firms.
References


EUROPEAN COMMISSION, 2009. “Challenges for EU support to innovation in services – Fostering new markets and jobs through innovation”, PRO INNO Europe Paper no. 12, Commission Staff Working Document, SEC.


PINA, K. & TETHER, B.S. 2016. Towards understanding variety in knowledge intensive business services by distinguishing their knowledge bases, Research Policy, 45 401–413.


