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Knowledge Exchange Between Universities and SMEs

The 'Situation' of SMEs

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Knowledge Exchange Between Universities and SMEs: The ‘Situation’ of SMEs

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Abstract

Exchanging knowledge between university and industry is generally known to be problematic. In this paper we address the situation of small and medium-sized enterprises (SMEs) in order to understand their use of knowledge: in particular scientific knowledge.

The paper will present data from a qualitative study of the situations of eight SMEs. The data consists of ‘walk-alongs’, situational maps, and thirty-seven semi-structured interviews. The goal is to provide an in-depth understanding of the numerous circumstances that influence SMEs’ interactions with universities and scientific knowledge.

The paper presents new understandings related to industry’s ways of perceiving, accessing and implementing scientific knowledge; these include insights into the primary ways in which SMEs appropriate new knowledge; the barriers to acquiring new knowledge; how SMEs understand the university setting; the ways in which SMEs access and utilise scientific knowledge; and the barriers to acquiring and utilising scientific knowledge. On the whole, the paper points out a need for universities to change their presentation and communication of scientific knowledge to SMEs; it also discusses the criteria for these new ways of communicating.

Keywords

Knowledge exchange, university–industry interaction, small and medium-sized enterprises, SMEs, situational analysis, qualitative study

1 Introduction

Exchanging knowledge between university and industry is commonly considered both beneficial and difficult to accomplish. Many authors have described in the literature a gap between research and practice (Bruneel, D’Este & Salter, 2010; Bucchi & Trench, 2014; Dasgupta & David, 1994; de Zubielqui, Jones, Seet & Lindsay, 2015; Rynes, Bartunek & Daft, 2001). In a variety of ways, this gap spans significant differences between university and industry: while universities engage with open and ‘leaky’ knowledge so that their ideas can be acknowledged by their peers, industry seeks private and ‘sticky’ knowledge that may be leveraged for competitive advantage (Bruneel et al., 2010). This is what Fukugawa (2013, p. 418) refers to as a ‘cultural gap’, which illustrates the fundamentally different situations and orientations of these groups. Most observers agree that overcoming that gap is profitable for universities, industry and society at large.

Universities have made different attempts to diminish this gap over the years; in addition to publishing, the formal university technology-transfer channel is patenting (Agrawal, 2001); university technology-transfer offices (TTOs) are also a widespread construction. As an institution, the TTO is responsible for the establishment of university–industry partnerships and for commercialising knowledge through licensing (Baycan & Stough, 2013; Berbegal-Mirabent, Sánchez García & Ribeiro-Soriano, 2015). Other mechanisms of transferring scientific knowledge include conferences and journals, recruitment, industrial consultancy, spin-off companies, collaborative research and industry-funded laboratories (Audretsch, Lehmann & Warning, 2004; Bruneel et al., 2010; Geuna & Muscio, 2009; Weigold, 2001)

The majority of initiatives are launched on university premises, however, and do not necessarily take the needs and obstacles of industry into account. Consequently, there is a notable need to 1) conduct research that will explore this gap from the industry’s perspective and 2) design solutions for knowledge exchange based on an understanding of the situation of SMEs.

Notably, the concept of transferring knowledge or technology recurs. In this paper we use the term knowledge exchange to stress an orientation in which interaction and dialogue are essential values for diminishing the gap between science and practice. This orientation is neither new nor unique. Indeed, the linear model – dominated by the ‘science push’ approach (Hodgson, 2002) and ‘deficit thinking’ (e.g. Miller, 2001) – for more than a decade has generally been considered outdated and ineffective (Bucchi & Trench, 2014). Instead, researchers consider the need for an ‘information pull from those who need it’ (Hodgson, 2002); they also see vertical and dialogical approaches (Doganova, 2013) as more effective due to the interactive and participatory nature of such approaches (Bielak, Campbell, Pope, Schaefer & Shaxson, 2008).

In this paper, we explore the exchange of knowledge between university and industry on industrial premises. Using a situational analysis approach (Clarke, 2005), we identify the circumstances of industry; we believe that having an in-depth understanding of the industry situation is key to developing new solutions for university–industry interaction (UII).

1.1 Defining the target group

The term ‘industry’ covers a large and heterogeneous group of enterprises. For the purposes of this study, we refrain from this term in favour of a more specific target group: small and medium-sized enterprises (SMEs). According to the European Commission’s definition of the term (2015, p. 3), SMEs are ‘enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro’. Different reflections have led to our choice of SMEs as an interesting subgroup to examine in this context. The first reason is that SMEs account for a substantial part of the EU economy. Nine out of ten enterprises in the European Union are SMEs; in 2013 over 21 million SMEs provided 88.8 million jobs throughout the bloc, which corresponds to two out of

three jobs (European Commission, 2015, p. 3). Second, due to the smaller scale in which SMEs operate, they generally have fewer employees and limited financial resources for in-house research and development (R&D); thus they have a greater need for accessing knowledge from external sources (Hausman, 2005; Ranga, Miedema & Jorna, 2008; Woolgar, Vaux, Gomes, Ezingard & Grieve, 1998). External knowledge acquisition thus becomes potentially more valuable to SMEs. Third, SMEs constitute an understudied target group in relation to knowledge exchange. Our aim – to learn about their situation and to use these insights for developing new exchange solutions – thus appears quite unique.

1.2 Research question

We examine in this paper the problems of scientific-knowledge exchange according to SMEs. To do this, we examine SMEs' situation (Clarke, 2005). By 'situation' we refer to the different circumstances that influence industry's use of scientific knowledge. Our research question thus is: What is the situation of SMEs? Understanding their situation, one of our goals is to strengthen industry's access to universities and scientific knowledge; another goal is to learn what universities must account for when making their knowledge accessible to industry. Analysing the situation of SMEs will thus form the basis for suggesting several criteria for new solutions to university–industry knowledge exchange.

1.3 Outline of the paper

We first review previous literature that focusses on SMEs' point of view; we then describe our method for conducting the situational analysis, and we present the results of our study. Finally, we will discuss the results and their implications on the design of new solutions to UII.

2 Literature review

Although much previous literature has focussed on UII – in particular on the university's part in this process – few studies have examined the perspectives of SMEs. Therefore, this perspective will be the main focus of our review. Furthermore, authors have paid a great deal of attention to describing the barriers to exchanging knowledge between university and industry; our aim is not to review these barriers in full, and we will refrain entirely from commenting on the barriers according to the university's side of the gap. Instead, we will mention a few of the common barriers that industry has mentioned: particularly SMEs, which will make up the second focus of our review.

Scant research has been conducted on understanding what we call 'the situation of the SMEs', although a few previous studies are worth mentioning. Woolgar et al. (1998) focussed on how SMEs identify and acquire new technology from universities; they illuminated the problem of SMEs, stating that 'SMEs are backward, isolated and re-

sistant to change and innovation' (Woolgar et al., 1998, p. 576). The authors characterised 'the SME-centric universe', which expresses an understanding that SMEs are at the centre of their own world (in particular with their suppliers and customers). Universities fall well outside the attention of most SMEs, a fact that Woolgar et al. explain by 1) SMEs' very specific and specialised concerns and 2) their weak R&D capacity and lack of a knowledge base for effective collaboration.

De Zubielqui et al.'s study (2015) attempted to understand how and why SMEs access external knowledge – especially from higher-education institutions (HEIs). The authors examined the processes by which 846 Australian SMEs acquired knowledge, concluding that the size of an SME is an influential factor in the way in which it accesses knowledge: the larger the SME, the more innovation is likely to take place. The authors' study also showed that only a small number of SMEs collaborate with HEIs. For SMEs that do collaborate with HEIs, knowledge is most likely to be acquired using generic and tangible transactional knowledge-transfer pathways such as published research results and the employment of recent graduates. In agreement with Woolgar et al.'s work (1998), the study also found that SMEs look to organisations other than universities to access external knowledge; the majority choose to collaborate with organisations that are closer to their own values and orientations. De Zubielqui et al.'s results also indicate that a shared location seems to be important, since SMEs are most likely to access knowledge within the same country, state/province or local environment.

Ankrah and AL-Tabbaa (2015) conducted a systematic review in which they examined what they refer to as university–industry collaboration (UIC). Their study found an increase in UICs in recent years, which pressures both universities and industry for several reasons. To industry, this pressure means a rapid technological transformation, a shortened longevity of products and an intense global competition. In this context, UICs are meant to improve innovation and economically competitive positions at institutional levels. The authors compared (amongst other factors) university's and industry's motivations, respectively, for entering into UICs. They found that industry has numerous motivations for doing so, including the necessity of acting in accordance with governmental initiatives and policies; gaining access to students and recruitment; gaining efficiency related to sales, R&D productivity and patenting activity; and gaining financial benefits and innovative outputs. Other benefits for industry include the development of human capital; the accessing of cutting-edge technologies; the augmentation of business capacity; the creation and stimulation of technology-based firms' (particularly SMEs') business growth; the lack of in-house R&D; the accessing of research networks and collaborations that involve multiple firms and universities (in addition to other types of collaborations); the enhancement of image, reputation and legitimacy; and the commercialisation of university-based technologies for financial gain. The systematic review showed that in order to secure a successful UIC, a functional interface between university and industry must exist. This is in line with the well-established idea of an intermediary as a tool for making UIC successful. Intermediaries (Acworth, 2008; Kodama, 2008)

can provide a helping hand in the UII, thereby actively strengthening the firm's 'absorptive capacity'.

The concept of absorptive capacity, which is also commonly discussed in the context of UII, deserves a mention here. The concept, which originated in two papers by Cohen and Levinthal (1989, 1990), refers to a firm's ability to utilise externally generated scientific knowledge. (See Agrawal [2001] for a review.) The general idea is that the smaller the company, the smaller the absorptive capacity (Decter, Bennett & Leseure, 2007), which correlates with de Zubieta et al.'s (2015) point that the larger the SME, the more innovation is likely to take place there. If SMEs have a smaller absorptive capacity, they will generally need more help accessing and implementing scientific knowledge; this highlights our reason for choosing SMEs as the specific target group of this study.

Alves, Marques and Saur-Amaral's study (2007) listed the following attitudes about UII: firms find it difficult to perceive technology as a factor of competitive advantage and therefore refrain from engaging with technology; most firms have short-term visions and focus on immediate and tactical objectives, which does not mesh with the uncertainties and occasional detours of the scientific process; firms tend to favour routine production approaches, since their organisational structures seldom show sufficient flexibility for absorbing new technologies; SMEs generally have insufficient resources (human, physical or material); firms face difficulties in identifying their own technological needs; and firms tend to misperceive the work of universities as being too advanced and specialised for solving practical problems.

Katz and Allen (1982) analyses the 'not invented here' (NIH), which represents a tendency of a project group to believe it possesses a monopoly of knowledge of its field and, consequently, to reject new ideas from outsiders. A mentality that 'We do not share our ideas and we do not accept foreign ideas' also exists. This position appears to be common to both university and industry.

Barbosa and Romero (2012) examined a broad set of firms' perceptions of the main benefits, barriers and outputs in firms' interactions with universities. Firms' motivations include the gaining of access to scientific breakthroughs and technological resources, the possibility of increasing the applied power of science and the delegation of selected developmental activities. The main barriers include the short-term orientation of industrial research, universities' and industry's different missions and goals, and the inadequacy of academic research (by its very nature) to industrial interest. In this regard, the contrast between 'leaky' and 'sticky' knowledge (Bruneel et al., 2010; Dasgupta & David, 1994) is worth another mention. The different cultures and motives – and the different behaviour that results – may lead to considerable disagreements and misunderstandings (Horng & Hsueh, 2005).

To summarise, this review has shown us that the many barriers and fundamental differences between universities and SMEs make for a challenging interaction between the two. Challenging as this interaction may be, however, it is also clear that success has

many benefits. We have pointed out several circumstances in our review, including the variance of absorptive capacities and innovative abilities; the modest contact made with universities due to SMEs' preference for engaging in relations with organisations that are closer to their own values and orientations; the apparent need for a local and shared connection; the orientation towards generic and tangible knowledge-transfer pathways; the wish for sticky knowledge that can be used for commercialisation and financial gain; the increased pressure to constantly evolve; the existence of a short-term vision and a focus on immediate objectives; the favouring of routine production approaches; the lack of resources (human, physical or material); and the existence of the aforementioned NIH mentality.

3 Data collection and analysis

We chose a qualitative and exploratory approach for our research, since the phenomenon we are studying – the situation of SMEs – is rather unique. The idea to study the situation of our target group originated from design thinking, where an understanding of the people and the context is crucial (e.g. Hassenzahl, 2010). To do this, we used the concept of 'situational analysis' (Clarke, 2005), which is a regeneration of the 'grounded theory' methodology. This offers an empirically and epistemologically sound approach to the study of social life through qualitative research. In situational analysis, the action-centred 'basic social process' concept (which is the conceptual infrastructure of grounded theory) is replaced with a situation-centred 'social worlds / arenas / negotiation' framework. In situational analysis, the 'situation per se becomes the ultimate unit of analysis, and understanding elements and their relations is the primary goal' (Clarke, 2005, p. xxii). While this idea of making the situation of the target group the centre of attention has motivated our study, we have not strictly adhered to situational analysis's approach in terms of data gathering or analysis/interpretation. Instead, we conducted a qualitative study involving three types of data: 1) walking observations and interviews – what Lykke and Jantzen (2013) calls 'walk-alongs' – at eight Danish SMEs, 2) situational maps that expose the major human and nonhuman elements in each SME (Clarke, 2005) and 3) thirty-seven semi-structured interviews with different employees at the eight SMEs. Together, this data provides an in-depth understanding of the situation in each of the SME and allows us to suggest various characteristics of their general situations.

3.1 Choosing a sample of SMEs

Even though SMEs are a specific group of enterprises in which certain commonalities do occur, the definition of an SME still covers a wide array of enterprises. We thus decided that the best way to uncover the situation of SMEs was to search broadly. In an attempt to find both commonalities and differences, we chose eight SMEs of very different sizes, subjects and ages. All of these SMEs, however, engaged in knowledge-

intensive work; by this we refer to dealing with knowledge and information (rather than handicraft and production). Table 1 outlines the eight enterprises' characteristics.

Subject	Number of employees	Age of company
Marketing and sustainability	2	1 year
Architecture and design office	11	19 years
Social media	15	5 years
Advertising and counselling	25	3 years
Concerts and cultural activities	150	1 year
Engineering and technology development	165	21 years
Energy production and energy trade	220	16 years
Banking and financing	250	100+ years

Table 1: Characteristics of the SMEs

3.2 Data collection

In the spring/autumn of 2014 we visited each of the eight SMEs for one to three days. To start off, we were given an introductory tour of the enterprise (including a presentation of the firm's history and its employees), followed by an interview with the CEO. These interviews focussed on understanding the enterprises' missions, goals and overall working methods. We were then given time to sit alone and make notes, draw up the situational maps and/or walk with the employees; we observed their ways of working as we did so. Finally, we conducted interviews with different types of employees. When doing so, we prioritised outlining their everyday situations and processes at work. The questions we asked included what their typical workdays looked like; how and where they spent the majority of their time; what programmes and tools they used, and for what purposes; who their close colleagues were, and how they worked together; what types of problems they typically faced; how they solved problems; what knowledge meant to them; where and when they sought new knowledge; and what the potential was for finding and implementing new knowledge (as well as the obstacles to the same). Another goal of these interviews was to learn about the interviewees' relationships with universities. As such, we asked them about their immediate understanding of universities and scientific knowledge, if they had ever used scientific knowledge in their current work and what obstacles/potentials they identified related to using scientific knowledge.

3.3 Analysing the data

The data determined the analysis process that was to be used. We used an open-coding process (Strauss & Corbin, 1990) of breaking down, examining, comparing, conceptualising and categorising the data during several iterations. We transcribed and read through each interview two to three times while at the same time establishing immediate categories. To some degree, of course, the interview questions had already formed the categories, as these automatically determined the overall direction of the conversation; but because all of the questions were open ended, their answers also varied. Using the

transcriptions and read-throughs of each of the interviews, we created an initial coding scheme. We later sorted the unedited quotes from the thirty-seven interviews under the relevant coding categories, thus allowing for a crosswise comparison of the data. Then, taking one category at a time, we refined the categorisation of every quote. After several iterations, each quote was made into a concept, which allowed for a statistical representation of the data. This will be the point of departure in our analysis. Note that not all respondents have answered all questions and that respondents were allowed to give more than one answer per question, which was a natural consequence of the open-ended questions. Number of respondents and number of quotes (n) will be indicated at each of the following figures.

4 Results and discussion

In order to answer our research question, it is relevant to understand how and where the SMEs seek new knowledge. Prior to this, however, the respondents were asked when they looked for new knowledge (i.e. in which situations). A clear pattern emerged: they did so when they had to solve a pressing problem or task. Because each of the respondents was allowed to discuss all of the work-related ways in which they sought new knowledge, an extensive list of concepts emerged from this process. For the purposes of clarity of this analysis, only the most frequently mentioned answers are presented below.

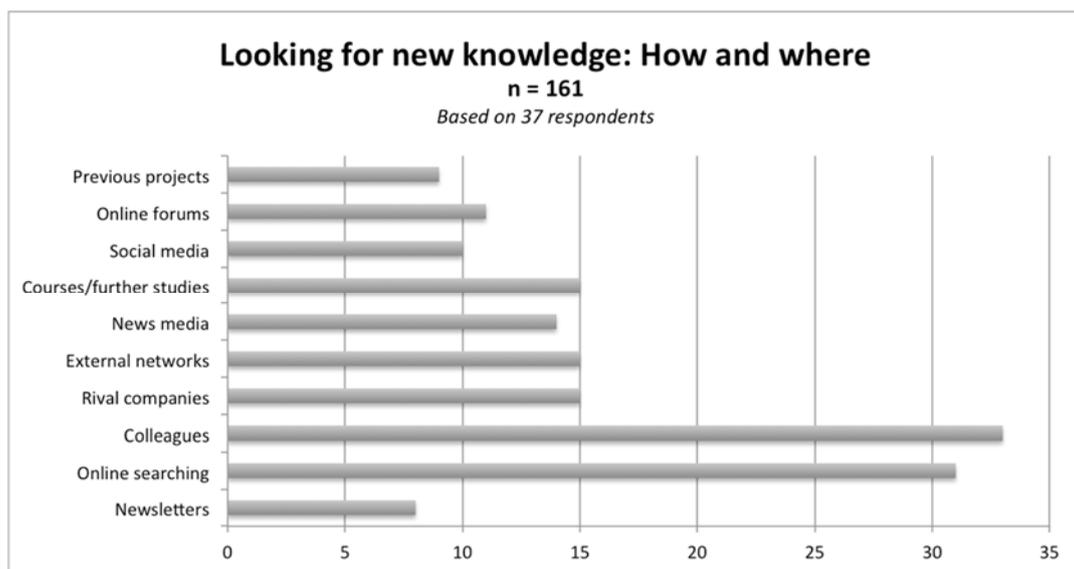


Figure 1: How and where SMEs look for new knowledge

Referring to ‘colleagues’ was the most common way to acquire new knowledge, which has several implications for the purposes of this study. First, it implies that employees prefer to access new knowledge through personalised channels. Second, it points out that employees in SMEs are accustomed to working closely together to solve problems,

which we can relate to the smaller number of employees of such firms. Third, asking a colleague is a quick and cost-effective way of learning something new or solving problems. These answers stress the need for the solution to come immediately and to be directly practicable. The use of 'external networks' also indicates this need for the solution to be easy accessible, personalised and inexpensive. Finally, asking a colleague can be said to nurture a habitual way of thinking and working, as a consequence of which the 'we know best' mentality can occur and dominate the work environment; this indicates a lack of motivation (or need) to look externally for new knowledge. The interviewees mentioned 'online searching' to be almost as important as consulting colleagues, however, which implies a desire to look beyond the enterprise for ways to solve tasks. The behaviour of engaging in online searching also points to the need for quickly accessible and inexpensive knowledge. 'Courses and further studies' also figured relatively highly, which indicates an orientation towards intensive training in a chosen and relevant subject. The employees' mentions of 'rival companies' and 'previous projects' both indicate a need for the new knowledge to be experience-based. To learn from others (and from one's own previous activities) can also be understood to be a time- and cost-effective method for seeking new knowledge. The use of 'online forums' – by which the respondents meant specific market- and business-oriented sites with (for example) news and chat functions – also indicates an orientation towards past experiences; it also stresses the need for the knowledge to be specifically related to a business area. The factor of 'newsletters' is related to this. Newsletters provide knowledge on the basis of one's own assessment of relevance, which also indicates the need for new knowledge to be quickly accessible, practicable and specific. These mentions of online solutions collectively describe a need for scientific knowledge to be present in cases where SMEs voluntarily engage in knowledge exchange.

To summarise these findings, the knowledge has to be easily and quickly accessible; personalised, experience-based and specific (i.e. according to the business or market area); and cost-effective and inexpensive (preferably free of charge).

4.1 Understanding of the university

Asking the SME respondents about their understanding of universities can provide insights into a few relevant initial understandings. An understanding of the university as 'a resource' – as something 'good, interesting and usable' – dominated the employee interviews; less mentioned were the more negative attitudes of the university as 'not relevant', 'too theoretical and not practicable', or 'a closed' and 'abstruse' world. This shows that universities are justified in their aspirations to improve their communication of scientific knowledge, but that these classical presumptions must still be overcome.

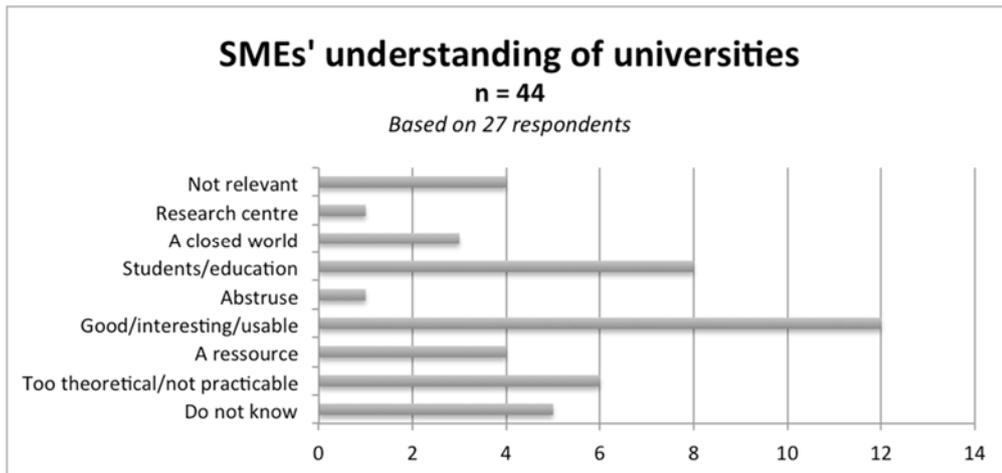


Figure 2: SMEs' understanding of universities

Noticeable from this is the large percentage of respondents who immediately thought of students when asked about the university and that few thought about research. It is not necessarily research, as such, that constitutes the primary knowledge product in the minds of the SME respondents. The fact that students are an easily accessible and inexpensive source of labour (which can be attractive to those SMEs with smaller budgets) could explain this.

4.2 Barriers to gaining knowledge

The barriers to acquiring new knowledge may be divided into two groups: 1) barriers determined by the SMEs' circumstances (that is, barriers that are out of the university's hands) and 2) barriers that universities can seek to comply with by communicating the scientific knowledge in a different manner. While both types are interesting to ponder in relation to our research question, the latter of the two is especially interesting for attaining our ultimate goal, which is to suggest new solutions that could facilitate UII.

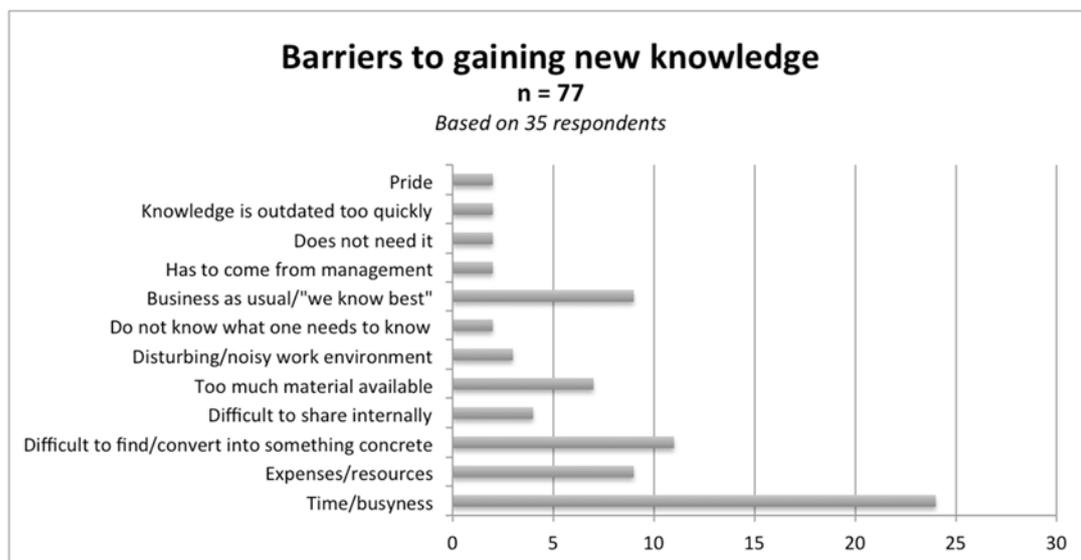


Figure 3: Barriers to gaining new knowledge

The reality of being busy and short on time was predominant in the responses, which means that browsing for new knowledge without a specific goal in mind is often not an option; only when absolutely necessary can time be allocated to gaining new knowledge. This relates to the factor of 'expenses and resources', both of which are scarcer among SMEs than among larger enterprises. The SMEs we interviewed also emphasised that new knowledge was 'difficult to share internally'. They did not have routines or standards for sharing knowledge internally: it was often simply a matter of coincidence if something was shared. This implies that even though scientific knowledge will successfully reach individual employees, ensuring that the SME as a whole will gain from that knowledge still remains a challenge. A 'disturbing and noisy work environment' was also a reality that universities could not influence, although knowing that this circumstance influences UII is important to bear in mind. That knowledge 'has to come from management' was a final barrier that is beyond universities' control.

The barriers that universities can actively work to diminish are the ideas that knowledge can be 'difficult to find and convert into something concrete'; that 'too much material is available'; that it can be difficult to 'know what it is you need to know'; and that attitudes of 'we do as we are accustomed to do' and 'we know best ourselves' – together with an immediate understanding of 'we do not need such knowledge' – was prevalent. It is the university's job to show the SMEs how to find scientific knowledge and to exemplify to these organisations how that knowledge can be converted into something concrete. Due to the reality that SME employees are always busy and short on both time and resources, this is not something the employees will do themselves. Similarly, universities must organise the material that is available in order to make the search more effective. Universities can also use communication to teach SMEs that they can gain from new ways of thinking and that they do not always know best themselves; the way in which new knowledge can be profitable has to be made immediately obvious. In particular, universities must show SMEs what it is that they need to know. Understanding their working situation would equate to accepting that SMEs will not themselves be the proactive partner in the relationship – they need the university to take on this role.

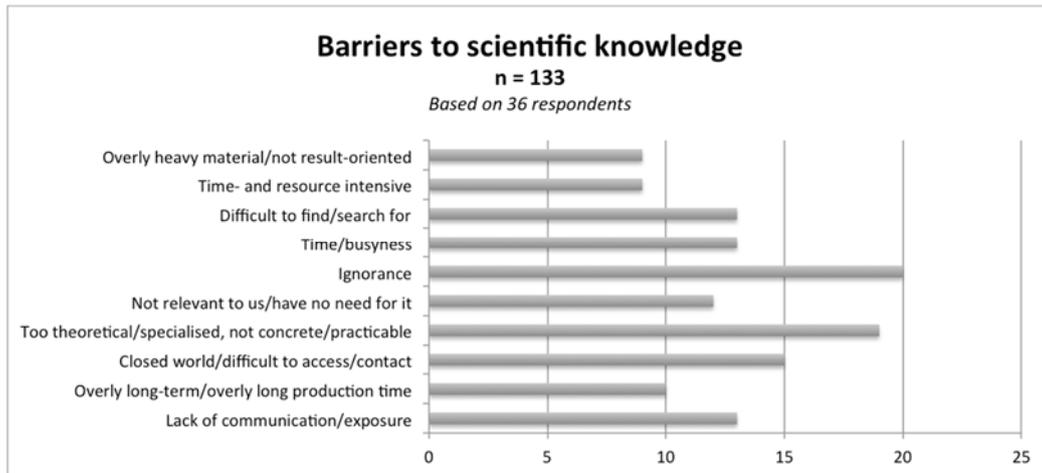


Figure 4: Barriers to scientific knowledge

Although the respondents listed numerous factors when asked which barriers the SMEs identified related to scientific knowledge, only the most frequently mentioned barriers are included here. The barrier the respondents mentioned the most was ‘ignorance’. This factor covers the situation in which SMEs are unaware of what universities could possibly contribute; SMEs do not know which subjects universities works in, or if universities work with knowledge that could somehow be relevant to them. At the same time, we found evidence that the respondents had an immediate understanding that scientific knowledge was ‘not relevant’, or that SMEs ‘had no need for it’. They also rated ‘lack of communication and exposure’ relatively highly. Universities thus must strive to be the proactive partner in the relationship and demonstrate to the SMEs what universities do – and how that knowledge can be of value. A related problem was ‘Difficulties in searching for scientific knowledge’, which conveys the idea of what we mentioned earlier: that it is difficult to know what one needs to know, and that the search for scientific knowledge is a real challenge if one does not know what universities knows (or what one could do with that knowledge even if it is known). As we discussed earlier, the SMEs we studied only allocated time for seeking new knowledge if that knowledge was related to the execution of a specific and urgent task.

The second-highest barrier was that the knowledge was ‘too theoretical and specialised and therefore not practicable’. This is a problem related to the form of the scientific knowledge. While changing this would require a great deal of work from the individual scientists and/or communications specialists involved, it is a circumstance that cannot be ignored if universities want SMEs to make better use of its scientific knowledge. The knowledge must be presented differently. Related to this is the problem the respondents cited where ‘the material is overly heavy and not result-oriented’. Universities must consider ways for transforming their knowledge into products that will meet the SMEs’ list of criteria. Another considerable barrier the respondents mentioned was ‘overly long production times’: SMEs generally work on a short-term basis, while universities do not. This often means that scientific knowledge remains beyond reach, since SMEs simply cannot wait for the knowledge to be produced and published.

4.3 Using universities

Asking if the respondents had ever used universities in relation to their current work, 51 percent answered ‘yes’. Of the 49 percent who answered ‘no’, common explanations were that it was of no particular relevance to them or that they could not imagine how they would do it. We were interested in learning how the 51 percent who answered positively had actually used scientific knowledge.

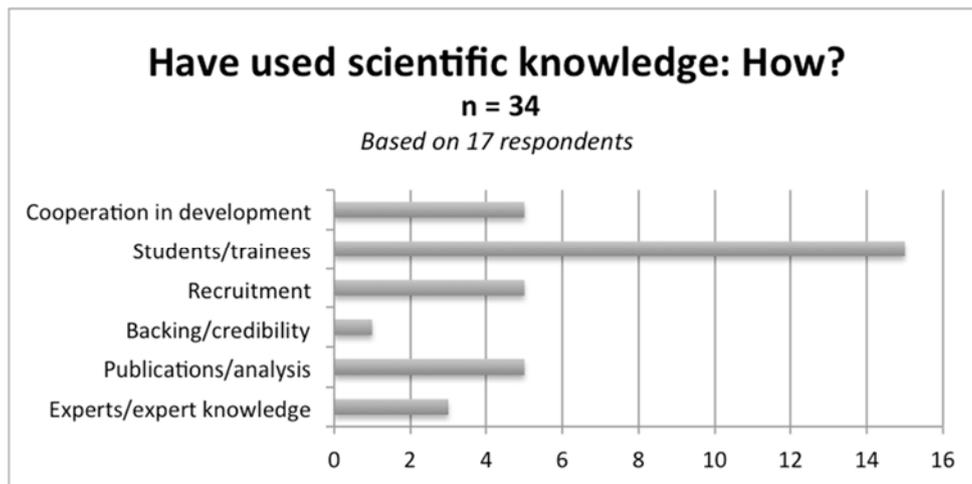


Figure 5: How SMEs have used scientific knowledge

The majority of the respondents mentioned students and trainees. As with our previous results, a large number immediately thought of students when they were asked about the university, which may be explained by the fact that students represent an easily accessible and inexpensive labour force. The fact that so few of the SMEs had actually utilised the other possibilities that universities offer, however, could be considered a source of untapped potential. Again, this responsibility falls on universities, which must take the lead in demonstrating to SMEs how scientific knowledge can be used.

5 Conclusion and recommendations

Facilitating university–industry knowledge exchange will entail several changes to universities’ present communications methods. First of all, having to take on a proactive role in the relationship constitutes a major change in attitude; it is not enough to simply provide scientific knowledge via (for instance) online research databases; targeted initiatives that account for the situation of the SMEs are also necessary.

Understanding that the SMEs primarily look outside themselves for knowledge when specific and urgent problems require doing so means accepting that universities must make the form of their scientific knowledge concrete and immediately practicable. Bearing in mind that time and resources are perpetually scarce among SMEs, shorter presentations must also be prioritised.

Employees at SMEs are inclined to seek out and ask sources they are familiar with, whether they are people or websites. They seek knowledge that is personalised, experience-based and specific according to the market or business area of concern. This means that universities must be visible where SMEs engage and interact: for example, in online forums, newsletters and news media. Universities cannot expect SMEs to visit a university website when these firms need to solve immediate problems; one reason for this is that SMEs are often confused about what it is exactly that universities offer. Needless to say, an SME will not visit a university website if the enterprise barely knows of its existence or what it can offer. Universities thus must show that they are an excellent source for inspiration and that they can deliver practicable inputs that can be implementable within a SME's timeframes. Only when universities prioritise marketing their knowledge according to SMEs' situations can a more successful exchange of knowledge be attained.

Universities must also clarify and make obvious which forms of interaction are possible. The respondents from the SMEs predominantly thought of students when they were asked about universities. Other forms of knowledge exchange must be promoted in order to obtain universities' full potential.

Overcoming the common mind-sets that 'we know best' and 'universities do not focus on subjects that are relevant to us' also presents a communication problem. New solutions will have to incorporate visualisations of scientific engagements – and the benefits of using them. These initiatives will help defeat the rather stereotypical idea of the university as an out-of-touch ivory tower.

Making it easier to search for scientific knowledge and to contact universities is also important. The knowledge has to be easily and quickly accessible and inexpensive – preferably completely free of charge. The idea that universities and scientific knowledge in general are laborious, abstruse and time-consuming must be dispensed with; scientific knowledge must be something that one can 'grab and use' as quickly and profitably as one could ask a colleague.

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