Technology Analysis & Strategic Management

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ctas20

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Published online: 08 Oct 2012.

To cite this article: Tom J.M. Mom , Ilan Oshri & Henk W. Volberda (2012): The skills base of technology transfer professionals, Technology Analysis & Strategic Management, 24:9, 871-891

To link to this article: http://dx.doi.org/10.1080/09537325.2012.718663

Technology Analysis & Strategic Management
Vol. 24, No. 9, October 2012, 871–891

The skills base of technology transfer professionals

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As the importance of technology transfer activities to the growth and survival of public and private organisations has become evident in recent years, researchers have been paying closer attention to the resources and capabilities such organisations will need in order to compete in markets. Yet it is still unclear what skills that individuals who are considering the various activities and contexts they are part of need. This paper investigates the skills that individual technology transfer professionals generally need and how the importance of each of these skills varies by context. It is based on a multiple-phase qualitative and quantitative study of technology transfer skills at the individual level. Results indicate the importance for technology transfer professionals to possess a range of five particular soft and business skills besides having two hard skills such as those related to intellectual property rights and domain-specific knowledge. Our results also highlight the heterogeneity in skills that technology transfer professional mainly draw on depending on the contexts of which they are part.

Keywords: technology transfer; professional; manager; skills; context

Introduction

There is a plethora of evidence from research that gains from successful technology transfer have a positive effect on markets and societies at various levels (Kumar et al. 2007). Technology transfer, in this context, is the process through which technological knowledge related to products or processes is transferred from one organisation to another for the benefit of business (Whittamore et al. 1998). In this process, technology transfer professionals apply various skills to accomplish technology transfer-related tasks. Although there is a growing body of evidence on the impact and process of technology transfer activities in universities, public organisations and private organisations (Siegel and Wright 2007), the studies that have been conducted fall short of providing a broad understanding regarding the skill sets that technology transfer professionals should develop and whether and how the skills needed differ depending on the context within which particular technology transfer activity takes place. Considering that the domain of technology transfer entails various activities in differing contexts and that past studies have tended to focus on understanding the resources and capabilities required in a particular context, this study has been positioned

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ISSN 0953-7325 print/ISSN 1465-3990 online

http://dx.doi.org/10.1080/09537325.2012.718663
http://www.tandfonline.com

to address two related research questions: (1) What skills do technology transfer professionals generally need to develop and obtain, and why? and (2) How does the importance of skills that technology transfer professionals need differ subject to the contexts within which they operate?

We have identified three shortcomings in the existing literature that motivated us to pursue these two research questions. First, studies traditionally investigate competencies supporting technology transfer at the organisational level, providing limited insight regarding the skills needed and developed at the individual level (Horng and Hsueh 2005; Lockett and Wright 2005; Markman et al. 2005). In this regard, we see an opportunity to distinguish between organisational and individual skills and competencies as individual skills may be influenced by the position a technology transfer professional holds and the role this person plays in the technology transfer activity. Understanding organisational competencies supporting technology transfer is imperative; however, we need a similar understanding concerning the skill base of individuals who participate in this area. We therefore posit that understanding the skills that individuals need may also advance understanding about required organisational competencies (Morgeson and Hofmann 1999).

Second, past studies have emphasised the importance of legal and intellectual property rights (IPR) competencies for the success of technology transfer activities. Indeed, such competencies ensure that the value of the technology remains with its creator and have been considered vital to successful technology transfer (Markman et al. 2005). In this regard, legal and IPR competencies were mainly perceived as referring to the management of patents and royalties (Colyvas 2007). Although there is an emphasis on competencies related to legal and intellectual property rights, the literature discusses other skills supporting technology transfer as well, such as those in marketing and negotiation (Horng and Hsueh 2005), teamwork (Large, Belinko, and Kalligsti 2000), innovation (Markman et al. 2005), business development (Lockett and Wright 2005), knowledge management (Gorman 2002) and entrepreneurship (Clarysse, Tartari, and Salter 2011). These studies have made significant contributions to understanding the role of each competency within the specific context it was studied. Nevertheless, we still lack an understanding of *the breadth of skills* that technology transfer professionals must have.

Third, past studies indicate that the required skill base of technology transfer professionals varies subject to the context within which a technology transfer activity is carried out (Kremic 2003; Landry, Amara, and Ouimet 2007). For example, some studies have focused on the transfer of technologies from universities to other organisations (Jahansson, Jacob, and Hellstrom 2005; Sharma, Kumar, and Lalande 2006), while others have considered technology transfer between business-oriented entities (Makhija and Ganesh 1997) or have pointed to heterogeneity of research based spin-offs (Mustar et al. 2006). Hence, although the literature indicates the need for distinguishing among various contexts within which specific skills are important for technology transfer, research about the impact of contextual factors on the importance of certain skills is limited (Landry, Amara, and Ouimet 2007). For instance, research in fields like strategic management and organisational learning has indicated that the skills that organisation members need differ according to their organisational roles and positions (Floyd and Lane 2000). Nevertheless, it is unclear how technology transfer skills differ depending on such roles and positions.

In summary, this article aims to deliver three contributions to the literature on technology transfer and its profession. First, we perform an extensive and broad-based investigation of technology transfer-related skills at the individual level. As a result of this examination, we propose and clarify the range of skills that technology transfer professionals need, thereby deepening our understanding of the breadth of skills that technology transfer professionals need. Second, we highlight the skills required across different contexts, clarifying the debate on the importance of various skills, in particular, the perception of hard versus soft skills for technology transfer professionals.

Our third contribution relates to the research approach itself. By conducting inductive qualitative research based on 37 interviews and a pilot survey, and subsequently conducting related confirmatory quantitative research based on a sample of 561 technology transfer professionals, we have created not only a rich understanding regarding the skills required and their contextual impact, but generalisable conclusions as well.

In the next section, we elaborate on the skills required and the role of context based on a literature review. The methods section provides details on the methods we applied, the samples, data collection and the development of the quantitative measurement instrument. Next, we explain the analyses and present the empirical findings. We conclude with a discussion of the results and implications and an outline of issues for future research.

A review of the relevant literature

Technology transfer skills at the individual level

Traditionally the academic and professional literature has emphasised the role that IPR have played in technology transfer (Rahal and Rabelo 2006). Indeed, IPR and other legal aspects of technology transfer are important. In this context, the term intellectual property denotes the specific legal rights that authors, inventors, and other intellectual property holders may hold and exercise, not the intellectual work itself. In law, intellectual property is an umbrella term for various legal entitlements that attach to certain names, written and recorded media, and inventions. The holders of these legal entitlements may exercise various exclusive rights in relation to the subject matter of the intellectual property (Lockett and Wright 2005). Intellectual property laws and enforcement vary widely from jurisdiction to jurisdiction, but there have been efforts to harmonise these across regions.[1] Ample evidence suggests that intellectual property protection is a significant determinant of economic growth (Lockett and Wright 2005). Evidence also suggests that limited property rights may in fact discourage inventors from making initial investments because they will not recoup their investment (Ordover 1991). Patent laws and antitrust rules provide protection and incentives for inventors that enable investments in R&D and later provide compensation when technology transfer activities take place. Thus, the role that legal brokers play in technology transfer has become central to both the incentive to innovate and the commercialisation of the invention (Rahal and Rabelo 2006). As a result, the literature on technology transfer has focused on the role that technology transfer professionals' IPR knowledge plays in successful (and unsuccessful) technology transfer projects (Siegel and Wright 2007).

Possessing domain-specific knowledge has also been widely reported as central to technology transfer professionals' activities (Gorman 2002). We define this term as the transfer professionals' specific technical knowledge of the product or sector they manage. Evidence suggests that the ability to register a patent on an invention is strongly associated with the domain-specific knowledge of the technology transfer professional (Vohora, Lockett, and Wright 2004). Furthermore, individuals within a company who possess critical domain-specific knowledge have been identified as having a significant impact on the transfer of technological knowledge between parties by having developed credibility as sector or product experts or by acting as gatekeepers (Katz and Tushman 1981).

More recent studies have highlighted additional skills that are imperative for technology transfer, such as business development, marketing and commercialisation (Siegel et al. 2003; Lockett and Wright 2005; Rahal and Rabelo 2006). Consequently, technology transfer professionals should develop both legal and domain-specific skills and knowledge, as well as softer skills to carry out

the wide range of activities associated with technology transfer. Indeed, several studies have examined nontechnical skills in the context of technology transfer. For example, Siegel et al. (2003) argue that legal skills are not necessarily the most critical ones for technology transfer; in fact, they say, business skills such as marketing are becoming more central to successful technology transfer projects. A more recent study has added to the panoply of skills the ability to communicate smoothly with external stakeholders and an entrepreneurial spirit (Dectera, Bennett, and Leseure 2007). Dectera, Bennett, and Leseure (2007) have pointed out that a lack of sufficiently trained technology transfer professionals in these areas acts as an obstacle to improving effectiveness in technology transfer engagements in both the public and private sectors.

It has emerged from the relevant literature that technology transfer professionals are expected to be multi-skilled experts who possess legal and specialised domain skills and knowledge, as well as an array of business skills critical for technology transfer activities (Lockett and Wright 2005). These studies, however, have focused on explaining the association of certain skills and traits with successful or unsuccessful projects rather than the need to understand the deep skill sets that technology transfer professionals should develop.

The context of technology transfer skills

Some skills may be more influential and necessary than others within particular contexts. However, research has by and large treated the context of technology transfer professionals to be rather homogeneous, ignoring the wide range of skills important for this work. One notable exception is Kremic's (2003) study, which highlighted the role that context plays in determining what technology transfer methods professionals should apply.

The range of contextual factors affecting technology transfer skills is broad. For example, studies examining the activities of technology transfer professionals tend to assume that such professionals mainly engage in activities related to technology commercialisation through the licensing of intellectual property (Sharma, Kumar, and Lalande 2006) when, in fact, these professionals typically engage in a wide variety of activities. Recent evidence suggests that technology transfer professionals perform activities in transfer and commercialisation efforts, such as those related to spin-offs, new business development and collaborative R&D (Ferrary 2008; Zhang 2009).

Similarly, technology transfer professionals hold various positions within organisations. Some are senior managers engaged in decision making and performance monitoring; others are middle managers or in entry-level positions, work that demands a skill set for carrying out the organisation's technology transfer strategy (Floyd and Lane 2000). Furthermore, the widely differing sectors in which technology transfer professionals operate often dictate the specific knowledge they need to carry out technology transfer activities successfully. Although the type of organisation, type of activities and role in the organisation and sector, for example, may have an impact on the set of skills that a particular technology transfer professional should have, previous studies have provided little insight into this impact.

Methods

We conducted a three-phase study using qualitative and quantitative data collection and analyses (Creswell 1994). Qualitative interviews and a pilot survey comprise the first and second phases and relate to the first and second research question: 'What skills do technology transfer professionals

Table 1. Overview of empirical research activities and main goals.

Research phase	Research activity	Main goals[a]	Sample size
Phase 1	Interviews	• To create rich insight into the types and range of skills that technology transfer professionals need, and why (research question 1) • To create a better understanding of the contexts within which specific skills in technology transfer are more or less important, and why (research question 2)	37 interviewees
Phase 2	Pilot survey	• To refine and improve the skills (research question 1) and contexts (research question 2) derived from the interviews • To improve the validity and reliability of the survey	44 respondents
Phase 3	Survey	• To create a more generalisable understanding on how the importance of the skills derived from the interviews and pilot survey differ across the various contexts as derived from the interviews and pilot survey (research question 2)	561 respondents; 543 usable responses

[a]Research question 1: 'What skills do technology transfer professionals generally need to develop and obtain, and why?' Research question 2: 'How does the importance of skills needed by technology transfer professionals differ subject to the various contexts within which they operate?'

generally need to develop and obtain, and why?' [Research Question 1] and, 'How does the importance of skills that technology transfer professionals need differ subject to the contexts within which they operate?' [Research Question 2]. The third phase was based on a large-scale quantitative survey and relates mainly to the second research question. Table 1 provides an overview of the research phases and activities, including their main goals and relationships to our two main research questions.

Phase 1: interviews

The first purpose of the interviews was to create a thorough understanding of the variety of skills that technology transfer professionals need and why, and to develop a preliminary list of these skills. The second goal was to create a better understanding about the contexts within which specific skills are more or less important and why. For these goals to be realised, it mattered to interview a wide variety of technology transfer professionals. We created a sample of 40 technology transfer professionals with help of two of the largest European associations of technology transfer professionals; the Association of European Science and Technology Transfer Professionals (ASTP) and the European Knowledge Transfer Association (ProTon). We ensured that our interviewees were from different European countries and active in various sectors and organisations – public research organisations, universities and private companies. Moreover, we ensured that they represented positions ranging from senior-level executives to entry-level employees, all carrying out work related to technology transfer.

Of the 40 technology transfer professionals we contacted and to whom we explained the purpose of this study, 37 agreed to participate. Interviews followed a similar protocol. We first described the research project and then asked the respondents a set of questions about their organisational roles and the types of technology transfer activities they carried out. We next asked them to explain which skills were imperative to successful technology transfer activities in their jobs, as well as skills important for technology transfer activities that are outside the scope of their job. Finally, we asked

them to indicate and explain contexts within which specific skills were more or less important and why. On average, an interview lasted about 45 minutes. When possible, interviews were recorded and fully transcribed. In addition, the interviewers took note of particularly significant insights regarding the skills that respondents outlined. We sent a summary of the main results of the interview phase to the interviewees as a feedback mechanism, which generated additional insight and some corrections.

Phase 2: pilot survey

In the second phase of the research, we conducted a pilot survey designed to refine and improve the list of skills and contexts derived from the interviews and to increase the validity and reliability of the survey (the third phase). The pilot survey drew on a sample of 44 technology transfer professionals. To save time and effort in gaining access to potential respondents, we asked each interviewee in the first phase to provide the names and contact details of up to two other technology transfer professionals who might be interested in contributing to the pilot survey.

Like the interview phase, the pilot survey sample was characterised by a wide variety of technology transfer professionals in terms of sector, organisation type and size, and position of the respondent. The survey first asked respondents to indicate the importance of each of the skills derived from the previous interviews using a five-point Likert scale, from 1 = not important at all to 5 = very important. Next, we asked respondents to indicate other important skills that were not on the preliminary list. Third, we asked respondents to what extent the importance of skills needed differ across each of the contexts derived from the interviews using a five-point Likert scale, from 1 = to a very small extent to 5 = to a very large extent. Finally, we asked respondents to provide additional contexts not offered in the survey where the importance of skills might vary.

Phase 3: survey

The third phase was a pan-European survey designed to create a more generalisable understanding on how the importance of the seven skills specified by the interviews and pilot survey differ across the five contexts specified by the interviews and pilot survey. Hence, based on the results of the interview and pilot phases, we developed a questionnaire that was distributed to 2962 European technology transfer professionals (see the Appendix). The sample was drawn mainly from pan-European professional technology transfer networks such as ASTP, ProTon and the European Competition and Industry Contact database. Members of these professional networks represent 22 of the 27 EU member states and cover a broad array of sectors, organisation types and organisations of different sizes. Members of these professional bodies represent a wide variety of demographic characteristics such as age, education, and formal organisational position. We received 561 responses, corresponding to a response rate of 19%, and reduced the final sample size to 543 in cases with missing information.

We examined differences between respondents and nonrespondents for the five contexts to test for nonresponse bias. Chi-square tests ($p < 0.05; \alpha = 0.05$) indicate that the distribution of the respondents over the sectors and types of organisations corresponds to the distribution of the sample to which the survey was sent. The t-test ($p < 0.05$) indicates that the average size of the respondents' organisations does not differ significantly from the sample's organisation size. We also compared early and late respondents (t-test; $p < 0.05$) in terms of the extent to which the professionals engage in different types of technology transfer activities and their organisational position since late respondents can be expected to be similar to nonrespondents (Armstrong and

Overton 1977). No significant differences were discerned, indicating that nonresponse bias should not be a factor in the analysis. The respondents' average age was 40.4 years (SD = 9.89). In terms of education; 74.7% of the respondents had a master's degree or higher; of those, 59.3% had a PhD or an MBA.

For each respondent, the survey measured the importance of each of the seven skills derived from the previous two phases of this research. A brief definition of these skills was provided in an Appendix to the survey. Using a five-point Likert scale (1 = not important at all to 5 = very important), respondents were asked to indicate the importance of each skill in enabling them to effectively meet their technology transfer-related job requirements. The survey also probed into the characteristics of the respondent with respect to the five contexts derived from the interviews and pilot survey. We asked respondents to: (1) identify the main sector in which the organisation is active based on the Standard Industry Classification (SIC), (2) provide the size of organisation in terms of the number of full-time employees, (3) identify the type of the organisation: university, public research organisation, company, or other nonprofit organisation, (4) identify the extent to which he or she was active in various technology transfer-related activities, including spin-offs, new business development, licensing or intellectual property protection, international technology transfer, national technology transfer and collaborative R&D, using a five-point Likert scale (1 = not active to 5 = very active), and (5) list their formal position using an open entry field.

Analyses and results

Interviews

We structured the qualitative data analysis process using a two-step coding procedure (Miles and Huberman 1994). First, we assigned codes to the text units (sentences or paragraphs) of the interview transcripts. For this first-level coding procedure, we used descriptive codes to gain a broad overview of the skills that the interviewees identified as necessary for them as technology transfer professionals. These codes entail little interpretation since they closely resemble the text of the interviews. Second, we identified underlying patterns by grouping the initial codes into a smaller number of more general or broader themes, often referred to as pattern coding (Miles and Huberman 1994). For example, codes like understanding end-customer needs (CUS-NEED), identifying business opportunities (ID-OPP), knowledge on major competitors (COMP), understanding economic developments (ECO-DEV), knowledge on how to close deals (DEAL) and awareness of cost effectiveness (COST-EFF) are examples of first-level descriptive codes that were grouped into the second-level pattern code, Commercial Awareness. Thus, we identified commercial awareness as one of the more general or broader skills that technology transfer professionals need. By following these procedures, we identified six more skills. Table 2 provides a list of these skills with a short description and relevance to the technology transfer profession.

Regarding the second research question (about the various contexts within which specific skills are more or less important), interviewees indicated varying degrees of importance of skills across four types of contexts: sectors, types of organisations, activity types, and respondent position. As to the types of organisations, interviewees indicated the importance of making a distinction between universities, public research organisations, companies, and what we labelled 'other nonprofit organisations', including technology transfer associations and non-profit technology transfer institutions founded by governments, universities, or sectors. Regarding the types of activities in which respondents engaged, the interviewees indicated the importance of making a distinction among six major types of activities in which a technology transfer professional may

Table 2. Skills that technology transfer professionals need: interview and pilot survey results.

Skill	Definition	Relevance to technology transfer
Commercial awareness	Individual and organisational awareness of the business environment	Understand opportunities to commercialise the invention
Networking	Understanding the importance of various members of a group, and aligning oneself with those most likely to advance one's objectives	Build a network of partners to extend the range of opportunities
IPR	The legal rights in creativity whether formally registered with a state agency or arising automatically and protected without formal registration	Protect returns on investment
Domain knowledge	The specific technical knowledge of a product	Understand the technology to ensure a sensible valuation of the invention
Negotiating	Set of interactions through which A and B influence each other's perceptions	Apply various negotiation tactics to maximise value
Communication	A set of information exchanges	Offer knowledge exchange channels to ensure engagement throughout the transfer process
New business development	The strategic approach pursued to ensure the growth of the economic enterprise	Translate the potential of the invention into an economic rent.

engage: activities related to spin-offs, new business development, licensing and intellectual property protection, international technology transfer, national technology transfer and collaborative R&D. Interviewees also indicated the importance of distinguishing between senior managers and others in the area of technology transfer. In the first group are professionals at senior levels of organisations active in technology transfer, such as CEOs, managing directors, general managers and the heads of technology transfer departments at, for instance, universities and public research organisations. In the second group are technology transfer professionals at lower levels, including frontline managers and employees at the entry level focusing on the execution of the organisation's technology transfer strategy.

Pilot survey

Respondents of the pilot survey supported the importance of the seven skills derived from the interviews. For each skill, the answer category that occurred most frequently to the question, 'How important is each of the following skills for you as a technology transfer professional?' was either 4 (important) or 5 (very important) for each of the seven skills. With respect to the open question to indicate important skills not listed in the pilot survey, 27% of respondents provided one or more answers. We applied the same coding procedures for these additional qualitative inputs as we did for the interview data. Having done so, we were unable to identify skills outside the seven previously identified; however, we were able to refine and improve the description of those seven skills. Most notable with respect to the commercial awareness skill, respondents indicated the importance of adding know-how regarding financial management and marketing.

Respondents also showed agreement with respect to the contexts derived from the interviews. For each of the four contexts derived from the interviews, the answer category that occurred most frequently to the question, 'To what extent does the importance of skills needed differ across

Table 3. Characteristics of the survey respondents along the five contexts.[a]

Main sector of the respondents' organisations (%)	
Agriculture & food	2.5
Biotechnology	9.8
Consultancy	10.5
Elect. & semicond.	2.9
Health care	5.2
ICT	6.4
Research	22.6
Education	17.6
Other	22.5

Distribution type of respondents' organisations (%)	
University	46.4
PRO	15.1
Company	18.6
Other nonprofit	19.9

Extent to which the respondents are active in various technology transfer-related activities[b]	
Spin-offs	3.24 (1.33)
New business development	3.45 (1.22)
Licensing and/or IP protection	3.66 (1.26)
International technology transfer	3.47 (1.19)
National technology transfer	4.08 (0.98)
Collaborative R&D	4.11 (1.12)

Size of the respondents' organisations (fte)
Mean = 521 (SD = 2888)

Distribution position of respondents (%)	
Senior manager	35.7
Nonsenior TT professional	64.3

[a]The five contexts are derived from the interviews and pilot survey.
[b]Five-point Likert scale: 1 = not active, 5 = very active. $N = 543$.
Abbreviations: ICT = Information and computer technology; IP = intellectual property; SD = standard deviation; TT = technology transfer.

each of the following contexts?' was 4 (to a large extent) or 5 (to a very large extent) for each of the contexts. When asked to add context not offered in the pilot survey in which the importance of skills may vary, eight respondents provided an answer, all indicating that the importance of desired skills may differ among organisations of various size. Table 3 provides an overview of the five context factors based on the interview and pilot survey results.

Survey

The answer category that occurred most frequently (i.e. the mode) to the question, 'How important are each of the following skills for you as a technology transfer professional?' was category 5 (very important) for communication (53%), networking (46%), commercial awareness (44%), knowledge of IPR and licensing (43%), and negotiation (41%). The mode for new business development (45%) and domain-specific expertise (36%) was answer category 4 (important). These findings concur with those of the interviews and pilot survey. That is, the survey data seem to support the conclusion from the interviews and pilot survey that the seven skills derived from the interviews and pilot survey were at least category 4 (important) for technology transfer professionals.

Because the main objective of the survey was to create a generalisable understanding on how the importance of the seven skills specified by the interviews and pilot survey differ across the five contexts specified by the interviews and pilot survey, we conducted ordinal regression analyses (ordered logit models). That is, we regressed the importance of each of the seven skills as a function of the five contexts: (1) the sector dummies, (2) organisation size, (3) three dummies corresponding to the four types of organisation, (4) the six technology transfer-related activities

and (5) the dummy for the position of the technology transfer professional. Table 3 shows the characteristics of the respondents in terms of the five contexts. Table 4 shows descriptive statistics and correlations for all variables. Table 5 presents the results of the ordinal regression analyses for the importance of each of the seven skills.

Table 5 shows that none of the coefficients pertaining to the variables sector, organisation size and type of organisation are significant, indicating that the importance of none of the seven skills differs across sectors, across organisations of different size, or across different types of organisations. However, several of the coefficients pertaining to the other two types of context are significant: the kind of activities the technology transfer professional engages into and the professional's position in the organisation. We will focus on Table 5 further to assess how exactly the importance of skills differs across kinds of activities and organisation position.

Differences across technology transfer activities

Table 5 shows, regarding the importance of communication, that the more a technology transfer professional is active in spin-offs, the less important that skill is ($b = -0.21; p < 0.01$). The model on the knowledge on IPR and licensing skill shows that the more a technology transfer professional engages in licensing or intellectual property protection, the more important that skill is ($b = 0.62$; $p < 0.001$). However, the more the professional engages in technology transfer activities in a national rather than an international context, the less important the knowledge of IPR and licensing skill is ($b = -0.17; p < 0.05$). The model on the networking skill shows that the more a technology transfer professional engages in new business development ($b = 0.15$; $p < 0.05$), licensing or intellectual property protection ($b = 0.20; p < 0.05$), or collaborative R&D ($b = 0.16; p < 0.05$), the more important is the networking skill. However, the more a technology transfer professional is active in spin-offs, the less important is the networking skill ($b = -0.18; p < 0.05$). Regarding negotiation, that skill is more important when the technology transfer professional engages more in licensing or intellectual property protection ($b = 0.33; p < 0.001$). The model on the commercial awareness skill shows that the more a technology transfer professional engages in spin-offs ($b = 0.15$; $p < 0.05$) or new business development ($b = 0.37$; $p < 0.001$), the more important is the commercial awareness skill. However, the more the professional engages in collaborative R&D ($b = -0.21$; $p < 0.05$), the less important is commercial awareness. Finally, the new business development skill is more important when the technology transfer professional engages more in new business development ($b = 0.49$; $p < 0.001$). Table 6 summarises these results.

Differences across positions

Table 5 shows that the coefficient pertaining to the senior manager dummy is significant in the communication ($b = 0.46$; $p < 0.05$), networking ($b = 0.43$; $p < 0.05$) and commercial awareness ($b = 0.35; p < 0.05$) models. This indicates that these three skills are more important for technology transfer professionals at senior levels than for nonsenior professionals. Table 7 summarises these results.

Discussion

There have been three important gaps in the research on technology transfer: limited attention has been paid to understanding technology transfer skills at the individual level of analysis, there is little understanding regarding the range of skills that technology transfer professionals need, and there has been little insight into how the skills required of technology transfer professionals

Table 4. Survey: means, standard deviations, and correlations.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Skill: communication	4.38	0.79													
2 Skill: knowledge in Ipr/licensing	4.19	0.85	0.19												
3 Skill: networking	4.19	0.91	0.47	0.13											
4 Skill: negotiation	4.16	0.88	0.41	0.44	0.21										
5 Skill: commercial awareness	4.14	0.93	0.24	0.13	0.07	0.19									
6 Skill: new business development	3.74	0.91	0.20	0.13	0.13	0.23	0.36								
7 Skill: domain knowledge	3.65	0.94	0.10	0.15	0.09	0.11	0.12	0.23							
8 Age	40.4	9.89	0.06	0.03	0.02	0.10	0.00	0.03	−0.06						
9 Education: postgraduate	0.59	0.49	0.00	0.06	0.02	0.10	−0.06	0.03	0.05	0.19					
10 Sector: agriculture and food	0.02	0.15	−0.03	−0.06	0.02	−0.03	0.06	0.04	0.02	0.00	0.01				
11 Sector: biotechnology	0.10	0.30	−0.04	0.06	−0.09	0.04	0.00	−0.08	0.02	−0.01	0.03	−0.05			
12 Sector: consultancy	0.10	0.31	0.03	0.02	0.04	0.03	0.07	0.11	0.04	0.05	−0.05	−0.05	−0.11		
13 Sector: electr. & semicond.	0.03	0.17	−0.06	−0.03	0.00	−0.08	−0.03	0.00	0.00	0.08	0.03	−0.03	−0.06	−0.06	
14 Sector: health care	0.05	0.22	0.06	0.05	−0.01	0.04	0.07	0.09	0.04	0.01	−0.03	−0.04	−0.08	−0.08	−0.04
15 Sector: ict	0.06	0.25	0.02	−0.08	0.05	−0.05	−0.03	0.05	−0.05	−0.04	0.05	−0.04	−0.09	−0.09	−0.05
16 Sector: research	0.23	0.42	−0.06	−0.02	0.00	−0.01	−0.09	−0.13	0.02	−0.01	−0.03	−0.09	−0.18	−0.19	−0.09
17 Sector: education	0.18	0.38	0.09	0.07	0.03	0.04	0.09	0.05	−0.08	−0.01	−0.02	−0.07	−0.15	−0.16	−0.08
18 Organization size (log fte)	2.09	0.79	−0.04	0.06	−0.05	0.01	−0.07	−0.14	−0.05	0.02	−0.05	−0.02	−0.02	−0.22	−0.02
19 Organization type: University	0.46	0.50	0.04	0.11	−0.02	0.07	0.04	−0.04	−0.08	−0.03	−0.04	−0.02	0.01	−0.15	−0.05
20 Organization type: PRO	0.15	0.36	0.03	0.06	0.01	0.04	−0.02	−0.01	0.06	−0.01	0.08	0.00	0.00	−0.13	0.02
21 Organization type: Company	0.19	0.39	−0.02	−0.13	0.02	−0.04	0.04	0.12	0.03	0.01	0.03	0.08	0.07	0.19	0.06
22 Activity: spin-offs	3.24	1.33	0.00	0.04	0.04	0.07	0.21	0.05	−0.06	0.09	0.02	−0.12	0.02	−0.05	−0.03
23 Activity: new business development	3.45	1.22	0.06	−0.03	0.11	0.07	0.28	0.30	−0.04	0.05	0.01	0.00	−0.04	0.02	0.01
24 Activity: licensing/IP	3.66	1.26	0.03	0.32	0.12	0.25	0.09	−0.06	0.00	0.05	0.06	−0.02	0.22	−0.13	−0.08
25 Activity: international TT	3.49	1.19	0.02	0.08	0.12	0.16	0.04	0.02	0.01	0.06	0.10	−0.10	0.10	0.14	−0.06
26 Activity: national TT	4.08	0.98	0.09	0.05	0.17	0.18	0.05	0.04	0.07	0.07	0.05	0.01	−0.01	0.05	−0.04
27 Activity: collaboration, R&D	4.11	1.12	0.06	0.11	0.15	0.07	−0.09	−0.07	0.04	0.01	0.06	−0.06	0.02	−0.14	0.05
28 Position: senior	0.36	0.48	0.12	0.03	0.12	0.12	0.12	0.07	−0.02	0.24	0.08	−0.02	0.03	0.00	0.03

(*Continued*)

Table 4. Continued.

	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1 Skill: communication														
2 Skill: knowledge in Ipr/licensing														
3 Skill: networking														
4 Skill: negotiation														
5 Skill: commercial awareness														
6 Skill: new business development														
7 Skill: domain knowledge														
8 Age														
9 Education: postgraduate														
10 Sector: agriculture and food														
11 Sector: biotechnology														
12 Sector: consultancy														
13 Sector: electr. & semicond.														
14 Sector: health care														
15 Sector: ict	−0.06													
16 Sector: research	−0.13	−0.14												
17 Sector: education	−0.11	−0.12	−0.25											
18 Organization size (log fte)	−0.06	−0.07	0.22	0.18										
19 Organization type: University	−0.03	−0.03	0.13	0.49	0.40									
20 Organization type: PRO	0.13	−0.03	0.14	−0.20	0.13	−0.39								
21 Organization type: Company	0.00	−0.03	−0.15	−0.22	−0.36	−0.45	−0.20							
22 Activity: spin-offs	0.04	0.07	−0.01	0.11	0.00	0.17	0.01	−0.10						
23 Activity: new business development	0.02	0.04	−0.03	0.10	−0.06	0.02	−0.05	0.10	0.42					
24 Activity: licensing/IP	0.10	−0.09	0.00	0.12	0.26	0.24	0.09	−0.14	0.36	0.14				
25 Activity: international TT	0.04	−0.04	−0.07	−0.09	0.01	−0.10	0.02	0.08	0.15	0.06	0.34			
26 Activity: national TT	0.02	−0.14	0.07	0.06	0.05	0.09	0.04	−0.09	0.20	0.15	0.39	0.42		
27 Activity: collaboration, R&D	0.04	−0.03	0.19	0.07	0.22	0.22	0.15	−0.23	0.13	0.00	0.30	0.20	0.42	
28 Position: senior	0.07	−0.01	0.03	−0.02	−0.15	−0.05	0.07	0.04	0.18	0.08	0.07	0.04	0.06	0.08

Note: $N = 543$. All correlations above 0.1 are significant at $p < 0.01$. All correlations above 0.08 are significant at $p < 0.05$ (two-tailed).

Table 5. Survey: results of ordinal regression analyses for importance of skills needed.

	Importance of communication *b* (SE)		Importance of knowledge IPR and licensing *b* (SE)		Importance of networking *b* (SE)		Importance of negotiation *b* (SE)		Importance of commercial awareness *b* (SE)		Importance of new business development *b* (SE)		Import of domain specific expertise *b* (SE)	
Sector														
Agriculture and food	−0.57	(0.58)	−0.77	(0.56)	0.37	(0.58)	−0.52	(0.56)	0.95	(0.61)	0.54	(0.57)	−0.01	(0.55)
Biotechnology	−0.33	(0.34)	−0.16	(0.34)	−0.57	(0.33)	−0.19	(0.34)	−0.01	(0.33)	−0.24	(0.33)	0.05	(0.32)
Consultancy	0.09	(0.33)	0.47	(0.32)	0.14	(0.32)	0.05	(0.32)	0.54	(0.32)	0.61	(0.32)	0.15	(0.30)
Electrical and semiconductors	−0.76	(0.52)	−0.12	(0.51)	0.00	(0.51)	−0.87	(0.50)	−0.12	(0.50)	−0.14	(0.51)	−0.09	(0.50)
Health care	0.28	(0.45)	0.14	(0.43)	−0.21	(0.41)	−0.14	(0.42)	0.78	(0.44)	0.74	(0.42)	0.39	(0.40)
ICT	0.13	(0.39)	−0.50	(0.37)	0.76	(0.39)	−0.35	(0.37)	−0.22	(0.37)	0.37	(0.37)	−0.30	(0.36)
Research	−0.30	(0.28)	−0.13	(0.28)	0.15	(0.27)	−0.20	(0.27)	−0.05	(0.27)	−0.41	(0.27)	0.10	(0.27)
Education	0.34	(0.34)	0.13	(0.33)	0.39	(0.32)	−0.10	(0.32)	0.39	(0.33)	0.22	(0.32)	−0.18	(0.31)
Organisation size														
Log full-time equivalent	−0.24	(0.13)	−0.23	(0.13)	−0.17	(0.13)	−0.22	(0.13)	−0.14	(0.13)	−0.19	(0.13)	−0.13	(0.12)
Organisation type														
University	0.53	(0.30)	0.15	(0.29)	−0.28	(0.29)	0.49	(0.29)	0.36	(0.29)	0.44	(0.28)	−0.20	(0.28)
Public research organisation	0.56	(0.32)	0.14	(0.32)	−0.17	(0.31)	0.49	(0.31)	0.32	(0.31)	0.51	(0.31)	0.09	(0.30)
Company	0.14	(0.28)	−0.47	(0.27)	0.03	(0.27)	0.00	(0.27)	0.18	(0.27)	0.39	(0.27)	0.03	(0.26)
Activity														
Spin-offs	−0.21	(0.08)**	−0.11	(0.08)	−0.18	(0.08)*	−0.14	(0.08)	0.15	(0.07)*	−0.11	(0.07)	−0.06	(0.07)
New business dev.	0.11	(0.08)	−0.06	(0.08)	0.15	(0.08)*	0.08	(0.08)	0.37	(0.08)***	0.49	(0.08)***	−0.06	(0.07)
Licensing/IP	−0.02	(0.09)	0.62	(0.09)***	0.20	(0.08)*	0.33	(0.08)***	0.04	(0.08)	−0.15	(0.08)	0.02	(0.08)
International technology transfer	−0.04	(0.09)	−0.02	(0.08)	0.07	(0.08)	0.07	(0.08)	0.05	(0.08)	0.03	(0.08)	−0.10	(0.08)
National technology transfer	0.13	(0.11)	−0.17	(0.10)*	0.12	(0.10)	0.19	(0.10)	0.04	(0.11)	0.10	(0.10)	0.19	(0.10)
Collaborative R&D	0.09	(0.09)	0.05	(0.09)	0.16	(0.08)*	−0.07	(0.09)	−0.21	(0.09)*	−0.06	(0.09)	0.04	(0.08)
Organisation position														
Senior	0.46	(0.19)*	0.06	(0.18)	0.43	(0.18)*	0.27	(0.18)	0.35	(0.19)*	0.21	(0.18)	−0.07	(0.18)
Control variables														
Age	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)	0.01	(0.01)	−0.01	(0.01)	0.00	(0.01)	−0.01	(0.01)
Education: Postgraduate grad.	−0.01	(0.18)	0.18	(0.17)	−0.02	(0.17)	0.21	(0.17)	−0.22	(0.17)	0.15	(0.17)	0.23	(0.17)
−2 log-likelihood	1082.94		1172.52		1256.99		1225.04		1255.94		1310.15		1421.78	
Model chi-square	39.17**		85.97***		44.76**		62.06**		83.68***		90.12***		20.57	
Nagelkerke R^2	0.08		0.16		0.09		0.12		0.16		0.17		0.04	

Note: Ordered logit models. Unstandardised coefficients are reported, with standard errors in parentheses. $N = 543$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 6. Survey: significant differences of importance of skills across activities.

The *more* the technology transfer professional is active in …	…the *more* the following skill is important for that technology transfer professional	…the *less* the following skill is important for that technology transfer professional
Licensing or intellectual property protection	• Knowledge of IPR and licensing • Networking • Negotiation	
National technology transfer		• Knowledge of IPR and licensing
New business development	• Networking • Commercial awareness • New business development	
Collaborative R&D Spin-offs	• Networking • Commercial awareness	• Commercial awareness • Communication • Networking

Note: This table shows the 10 significant relationships of Table 5 pertaining to the technology transfer activity-variables.

Table 7. Survey: significant differences of importance of skills across the formal position of the technology transfer professional.

In case the technology transfer professional is …	…the *more* the following skill is important for that technology transfer professional	…the *less* the following skill is important for that technology transfer professional
A senior manager	• Communication • Networking • Commercial awareness	
At lower levels than senior		• Communication • Networking • Commercial awareness

Note: This table shows the four significant relationships of Table 5 pertaining to the senior dummy variable.

vary with context. Our objective has been to contribute to bridging these gaps by conducting a multiple-phase qualitative and quantitative study of technology transfer skills at the individual level, raising important issues for both the literature and practice.

Explaining imperative technology transfer skills

Past studies have emphasised the importance of hard skills for technology transfer professionals, such as on intellectual property rights and technology-specific domain knowledge and expertise (Lockett and Wright 2005; Rahal and Rabelo 2006). Our study, in line with some fragmented past observations (Dectera, Bennett, and Leseure 2007), highlights the importance of soft and business skills as well. By highlighting the importance of soft skills, we by no means undermine the importance of hard skills such as IPR and legal skills. Indeed, our survey results indicate that the mode to the question, 'How important are each of the following skills for you as a technology transfer professional?' is 'very important' for IPR and legal skills, thus requiring technology transfer units and offices to ensure access to such skills. The mode for domain-specific knowledge,

however, was considered only important (category 4); it has been identified in that sense as the least important skill in this study, suggesting that technology transfer professionals are least concerned about the possession of such skills. The findings of this study show that technology transfer professionals should develop the following soft skills: communication, networking, negotiation, commercial awareness and new business development. Although the importance of these skills has been confirmed in this study, there is a need to clarify the meaning of each one in the context of technology transfer.

In this regard, *communication* refers to the exchange of thoughts, messages, or information through speech, signals, writing, or behaviour. In the context of technology transfer, the collaboration between transfer parties often relies on the ability of the actors to communicate with each other. Various factors can negatively affect communications between parties, such as differences in skills base (technical, market, or product related) or language and cultural differences (Goh 2002).

Networking is the skill of understanding the importance of various members of a group and aligning oneself with those most likely to advance one's objectives. In practice, networking is the skill of building and maintaining contacts with various networks. In this regard, these networks may be seen as social networks that promote the creation and transfer of knowledge. Networking becomes imperative for technology transfer not only to open channels for allocating new and original technologies through one's own social network, but also for building trust within a social network to ensure that the entire transfer of technology is successful. Seufert, von Krogh, and Back (1999) use the term *knowledge networking* to signify a number of people, resources and relationships that are assembled in order to accumulate and use knowledge, primarily by means of knowledge creation and transfer, for the purpose of creating value. In this regard, knowledge networks may be understood as social networks among knowledge actors that allow the creation and transfer of knowledge on individual, group, organisation and interorganisational levels. Networking is not only for allocating new technologies but also for creating a culture of trust (Granovetter 1985). According to Granovetter (1985), many attempts at rational, economic action are actually embedded in social relations, that is, creating 'the role of concrete personal relationships and structures of such relationships in generating trust and discouraging malfeasance' (p. 490). Evidence suggests that technology transfer professionals who have strong networking skills can improve the transfer of technology through the formation of strong ties between and among professional networks (Mosey, Lockett, and Westhead 2006).

Technology transfer also requires *negotiation* skills (Siegel et al. 2003). *Negotiation* refers to the set of interactions through which A and B influence each other's perceptions to, for example, resolve disputes, agree on a course of action, bargain for an individual or a collective advantage, or craft outcomes to satisfy various interests. Negotiation has two basic elements: the process with respect to how the parties negotiate and the substance over which the parties negotiate. In the context of technology transfer, research has persistently shown that organisations fail to benefit from the commercialisation of their technology due in part to poor negotiation skills (Siegel et al. 2003). Negotiation skills in this regard should take into consideration different behaviours, attitudes, norms and values that negotiators from different countries could present. Some studies have examined the role of negotiations in technology transfer. For example, evidence suggests that because of poor negotiation skills, technology transfer officers often fall into the trap of asking for too much money for technology that was not deemed (Reeder, Brierty, and Reeder 1987). Clearly negotiation skills are often difficult to develop detached from other sources of knowledge, such as domain and legal knowledge; therefore, the impact of negotiation skills can be powerful when combined with additional skills.

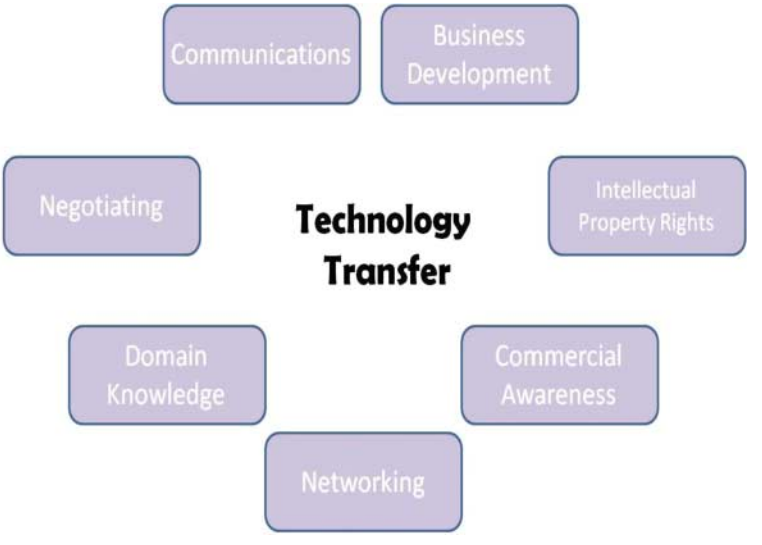

Figure 1. Key skills in technology transfer.

Commercial awareness refers to having an awareness of the business environment that is important to strategic decisions. In the context of technology transfer, commercial awareness relates in particular to recognising the potential commercial prospects of a technology (Lockett and Wright 2005). Developing this skill revolves around recognising and acting on business opportunities (e.g. spin-offs) by maximising the returns on investment made (Lockett and Wright 2005). Indeed, the CREST OMC Expert Group has identified commercial awareness as the most important skill for technology transfer officers, echoing a recent study by Lambert (2003), who revealed that the lack of commercial awareness has led UK universities to misjudge their spin-off approach in their technology transfer engagements.

Finally, *new business development* is imperative for technology transfer professionals and regards the strategic approach pursued to ensure growth of the economic enterprise. Business development focuses on implementing a strategic business plan that may consist of various business tactics, such as equity financing; acquisition of technologies, products and companies; or the establishment of strategic partnerships where appropriate (Daneels 2002). In the context of technology transfer, new business development is the ability to consider various options available to a technology transfer professional and their impact on the economic success of the firm.

Explaining heterogeneity in imperative technology transfer skills across contexts

This study also highlights the importance of heterogeneity in the technology transfer profession. Whereas a few studies on technology transfer (Kremic 2003) note that the importance of skills may differ across contexts, most of these viewed the context of technology transfer professionals to be rather homogeneous, ignoring the variety of skills needed for working in different contexts. Based on our literature review, interviews and pilot survey findings, we expected that sector, organisation size, organisation type, the technology transfer professionals' activities and these professionals' organisational positions would have an impact on the importance of certain skills. Surprisingly, the survey results reveal that only activities and position may have such an impact.

Hence, our quantitative results indicate that the higher-level contextual factors such as industry and organisational level characteristics do not significantly relate to differences in importance of skills, but that lower-level contextual factors do. In essence, our quantitative results indicate that for understanding differences in the importance of skills needed across a variety of technology transfer professionals, industry or organisational differences among these professionals do not matter. What does matter is understanding differences at the work context level of analysis; i.e. the differences relating to the professional's specific technology transfer activities and those relating to the roles or position the professional fulfils in the organisation. Such results suggest that the skills identified in this study become available to the organisation at the sector and organisational level through channels such as external service providers (particularly in the area of legal and IPR support); therefore, these are not perceived to be critical at the higher level of contextual factors. A lower level of contextual factors implies a higher degree of specialisation and context dependence, which results in the perception that certain skills are critical for technology transfer professionals to have. Hence, our results suggest that technology transfer professionals should be aware of the skills they need to develop for the activities they engage in and the position they fulfil in their organisation.

Implications for practitioners

The success of technology transfer projects and the career trajectory of technology transfer professionals depend on the set of skills applied during work. In this regard, this study highlights the importance of acquiring soft skills along with the necessity of having hard skills. However, technology transfer professionals should take note of the variation in the importance of skills depending on work context. Those who engage in business development activities should especially invest in acquiring networking, commercial awareness and new business development skills. Those involved in collaborative R&D should pay attention to acquiring networking skills and those involved in licensing require, in addition to IPR, networking and negotiation skills. Finally, those involved in spin-offs should pay attention to developing commercial awareness. Furthermore, our study indicates that senior managers involved in technology transfer should pay particular attention to developing a range of soft skills. Such soft skills are less important for entry-level professionals. This corresponds to studies on, for instance, individual performance which indicate that effectively dealing with personal interdependencies – for which soft skills are crucial – becomes increasingly important for organisation members when they move towards higher hierarchical levels (Griffin, Neal, and Parker 2007).

Concerned with the competitiveness of the EU, the European Commission (EC) set an objective of improving the transfer of technologies across sectors, organisations and technology transfer professionals in the EU. A report provided by an EC-funded project code-named CREST concluded that in spite of the importance of developing skills in the area of technology transfer, the EU area lacks a programme to train professionals who are engaged in technology transfer with the range of skills that have been empirically confirmed as critical for this function.[2] In line with the results of this study, it becomes evident that a coherent training programme for technology transfer is needed. Furthermore, our study also confirms that policymakers should promote the development of a technology transfer training programme across sectors and types of organisations at the European level, as there is insignificant variation in the importance of skills across sectors or types of organisation. In this regard, technology transfer training programmes should be similar across Europe and should offer training modules for the seven skills identified in this study. Although national training programmes may emerge based on local demand, we

propose that policymakers such as professional associations coordinate the emergence of training programmes across Europe to ensure consistency in content and quality.

In designing a training programme, training providers should pay particular attention to offering certain skills modules according to the organisational role of the trainee and the type of activities the trainee carries out to ensure that trainees acquire the skills they need for work. We also propose that trainers design training modules for these entry-level technology transfer professionals separate from those offered to senior managers involved in technology transfer. We believe that in addition to the different sets of skills needed by these two roles, there is a need that senior managers develop the proficiency in the skills more important for them to have. Furthermore, analysis showed that certain skills are equal in importance, suggesting a modular approach in which trainees can choose the skills module they would like to take first.

Future research

Understanding which skills are imperative for technology transfer professionals is an important step in the development of a theoretical construct within the technology transfer body of literature. Because technology transfer professionals operate within various sectors and organisational settings, additional research is needed to test the results reported in this article. In this regard, we see an opportunity to broaden the scope of research on skills needed by considering the outsourcing of some technology transfer activities to service providers. For example, small and medium-size firms are not likely to develop intellectual property and legal skills in-house and instead typically seek advice from local and international legal service providers. In this regard, it is not clear which of the skills identified in this study are candidates for outsourcing and under what conditions. Moreover, because the application of skills implies a learning capability, future studies should advance our understanding regarding the ability of the individual and the organisation to absorb knowledge subject to various contextual factors and, consequently, the impact on technology transfer projects. Related to this, for instance, the literature on corporate spin-offs and university spin-offs indicates that different characteristics in technological knowledge involved influence spin-off performance in a different way, depending on whether the technology transferred is from a corporation of university (Clarysse, Wright, and Van de Velde 2011). Hence, future studies may investigate how the skills needed by technology transfer professionals depend on different characteristics of the technologies involved in combination with different contexts in which the technology is being transferred. Furthermore, although this study highlights the importance of a range of skills subject to certain contexts within which a technology transfer is carried out, it is also of importance to further our understanding of combinations of skills to be developed and applied subject to the technology transfer activity. For instance, future studies can examine the combination of skills that are critical for technology transfer professionals in their relevance to a particular technology transfer activity. Finally, future studies could investigate how and to what extent other factors explain the importance of various technology transfer skills. As explained in the discussion section, our study seems to indicate in this respect that investigating lower-level contextual factors such as, for instance, specific task-related demands or functional positions (Griffin, Neal, and Parker 2007), may be a more fruitful direction for future research than investigating higher-level factors. Despite these limitations and suggestions for future research, this study may make a valuable contribution to the literature on technology transfer and to its practice by having clarified the skills that individual technology transfer professionals generally need and by having investigated how the importance of these skills varies subject to various contexts.

Notes

1. See recent developments at http://www.aseansec.org/17071.htm.
2. The project is the Certified Trans-National Technology Transfer Manager, under the Sixth Framework Programme of the European Community.

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Appendix: Survey measures and items

Importance of skills

[*Items were measured on a five-point scale*: *1 = not important at all, 2 = unimportant, 3 = neither important nor unimportant, 4 = important; and 5 = very important*.]

How important are each of the following skills for you as a technology transfer professional?

- Commercial awareness
- Domain-specific expertise
- New business development
- Negotiation
- Knowledge on intellectual property rights and licensing
- Networking
- Communication

Sector

[*The respondent had to select 1 out of 16 sectors based on the Standard Industry Classification, including a category labeled 'other'*.]

Which sector best represents your line of business?

Organisation size

[*This was an open entry field.*]

What is the size of your organisation (number of full-time employees)?

Type of organisation

[*Answer categories: university, public research organisation, company, or other.*]

What type of organisation are you in?

Technology transfer activity

[*Items were measured on a five-point scale, from 1 = not active to 5 = very active*.]

Regarding technology transfer; to what extent are you active in the active in the following areas?

- Spin-offs
- New business development
- Licensing or intellectual property protection
- International technology transfer
- National technology transfer
- Collaborative R&D

Position

[*This was an open entry field.*]

What is your formal position in your organisation?