Research-Based Spin-Off Firms as Sources of Knowledge Spill-Overs

Anna I. Pobol

Abstract

The emergence of a stratum of innovative, application-oriented researchers appears to be a valuable chain strengthening the weak 'university-science-industry' linkages. Their role is, however, not merely restricted to this commonly accepted function of technology transfer. My argument is that by extending our vision of the relationship types emerging around research-based spin-off firms (RSOs) and their character from the commonly recognised parent-RSO-customer relationship to a wider network, while also recognising the duality of these interactions, we can better understand the role of RSOs in the economy and in the national innovation system in particular. I try to justify the argument that beyond the commonly recognised market forms of R&D and technology transfer, spill-overs take place, which are not accidental but have already become an institutionalised process. The high interconnection and overlapping character of high technologies per se also contributes to positive path dependence creation on the basis of spill-overs.

Putting the question

The empirical background of research and the unit of observation are the small enterprises based on technological developments of former researchers from public research institutes ('research-based spin-off firms', or RSOs) in the transition economy of Belarus.

The objects of research are the relationships being formed around RSOs in their networks in terms of technology, knowledge, and competence transfer to the economy.

Problem outline. The aim of this paper is to study the channels for R&D and knowledge transfer by RSOs, their forms and content. I try to show that beyond the commonly recognised market forms of R&D and technology transfer, spill-overs take place, which are not accidental but have already become an institutionalised process.

Box 1. Storyline of RSO emergence in Belarus

Transformations in the system of innovation activity organisation started in the early 1990s, after a period of 'institutional vacuum'. As some research institutes became disaffiliated from Union subordination, they received greater freedom in forming strategies for their research activities and collaboration with industry. At the same time, this freedom meant a reduction of financial funds for R&D activities. It was for this reason that the management of public research institutes started to increase the share of business contracts and reorient their activity to the final stages of the innovation cycle. Numerous companies have been established by researchers and with the share of 'parent' public research institutes, aiming at promotion on the market and commercialisation of scientific and research developments generated by researchers. In western Europe similar firms founded by researchers based on their intellectual capital began to emerge about 30 years ago and in the USA in the 1930–40s; since they have not yet been defined in the literature, we here use the term «research-based spin-off firms», or «spin-offs», as the sprouts grown from their parent research institutes.

As shown by Griliches (in Cohen et al. 2002), inter-industrial (non-material) R&D *spill-overs* are the major source of productivity growth in the economy. Flows of information about R&D, even between competitors, are actually responsible for the diffusion of technologies in a system. The transmission of information in the form of non-market transactions (such as publications, participation in exhibitions and conferences, informal information exchange and products of competitors) results in a 'spill-over' effect—an externality, a flow of knowledge which brings to its initial owner no reward or direct compensation for the information obtained by the recipient. The *intensity* of knowledge and technology spill-over flows depends on the protection of intellectual property rights (patents, confidentiality regulations etc.), as well as on the presence of actors who function as 'conductors' of these flows in an economic system. Having studied the dynamics of the transformation system of science and technology organisation in the transition economy, I have come to the conclusion that there is only one actor in the system which actually acts as a technology, knowledge and innovative skills broker, diffuser, and amplifier—the RSO. The present paper explicitly concentrates on how this is done.

Literature review: Gaps and context

The available scientific and documentary publications which deal with RSO issues may be divided into two groups: the *descriptively-statistical* ones, and those addressing the issues of the *sociological nature of network communications*. European scientific studies generally consider the stratum of research-based spin-offs as a given fact of a developed economy, they estimate the degree of RSOs' diffusion, identify the barriers to their development, but analyse neither the qualitative processes and dynamics connected with their appearance, nor the qualitative changes in the economy caused by RSO emergence as a new element of the system.

Some few studies touch this research question very briefly. Thus, Semadeni (2003) integrates the agency theory, the upper echelons theory and transaction costs economics in order to build a model of spin-off firm organisation. This investigation does not, however, address the question of technology diffusion through spin-off firms. In an opposite approach, Fuentelsaz et al. (2003) concentrate on speed and factors of technological innovation diffusion, but remain at the intra-firm level. An important contribution to the development of a spin-off firm theory is provided by studies investigating the relationships between the spin-off and its parent company in terms of resource sharing (Dahlstrand 1997; 2000; Pavitt 1991; in Parhankangas & Arenius 2003), highlighting those relations that lead to the emergence of networks for the development of industrial clusters. Pointing out knowledge distribution through such relations, however, these authors deal with corporate business and the prosperity growth of regions with spin-offs acting as agents. We are more interested in the networks and the dynamics of their development *between the science-intensive enterprises, especially in conditions of a transition economy*. Lastly, Chesbrough (2003) has also dealt with technology spin-offs, but concentrates on effective structures of their governance, which is again at microlevel.

Of special importance for our particular issue are the studies about knowledge and R&D spill-overs, which are raised mostly in connection with multinational corporations (MNC) and knowledge-seeking foreign direct investments (FDI) (Cantwell & Mudambi 2003; Narula & Zanfei

2004). Beyond this, such domains of research literature as Actor-Network Theory (ANT) originating from sociology (Giddens 1993; Latour 1999), as well as institutional economy (Coase 1998; Commons 1931; North 1971) are indispensable for studying the questions asked in our analysis, though until now they have not addressed the RSO issues directly.

Research methodology

The present paper is a part of a wider study of RSO functions in the formation of a national innovation system. It is based on the methodology of 'theory building from case studies', developed by Eisenhardt (1989).

Most previous empirical investigations of academic entrepreneurship have employed as the source of information either the 'parents'—the university or research organisation from which the RSO has spun off—, or the supporting organisational structures—such as business incubators—which are strictly speaking external to the functioning of RSOs and to the process of technology creation and diffusion on the market. In our analysis not only the spin-off firms themselves were used as sources of information, but additional multi-level data were collected, which allows studying the quality of RSO relationships with other actors on the technology market—in the 'supplier-client' chain but also in the chain of knowledge and technology diffusion (as second generation spin-offs).

Field empirical data were obtained by direct communications with respondents. On the basis of a preliminary analysis of previous empirical data (Gordienko et al. 2002; Pobol 2004; Smallbone et al. 2002) the questionnaire was applied for all RSOs. Its aim was to identify the RSO where the 'external links' with clients, suppliers and second generation companies and the relations of technological collaboration are most developed. The data gained was analysed using the cross-case analysis method (Ragin & Becker 1992) in order to reveal the similarities and diversities between the cases in concrete dimensions. Verification of hypotheses was done through such mechanisms as *iteration character of research* and *opportunistic data collection* through in-depth studies.

Our study in this paper will first turn to the identification of the network structure and the character of relationships around RSOs, with specific attention paid to those relevant to technology, knowledge and competence diffusion. Second, we will present some empirical findings to illustrate the content of these relationships. And lastly, we will try to apply the evidence to analyse the issue under consideration here.

Research findings

Developing the taxonomy of RSO relationships

Research studies carried out in the European Union and in the transition economies have produced the following facts: spin-offs, being a small subset of new technology based firms, and a very small subset of new firms, are innovation-oriented enterprises, which as a rule are established by scientists and researchers from public research institutes and universities. These founders develop the ideas from the fundamental research level in their entrepreneurial activity, with the purpose of finding a market application for their R&D results, sometimes using assets from the parent organisation.

The distinguishing essential features of spin-offs are that they have been established by academics (BMBF 2002) and that they are based on new knowledge or new technologies from public research. In this context, spin-off firms were divided into *competence spin-offs* (if the firm is based on special skills and knowledge developed during the founder's activity in science) and *realisation spin-offs* (if the firm is based on concrete research results of the spin-off founder or methods developed by him). The lesson one could draw from this differentiation is based on the recognition of the *basic functions* that enterprises fulfil in the economy—whether they transfer knowledge and technologies, and whether this is the core of their activity.

The following four functions are generally assigned to research-based spin-offs in the literature:

– *Employment* (RSOs are seen as an important element in the transition to the knowledge-based economy, creating the potential of employment in quickly growing industries).

– *Realisation* (RSOs are considered to be an important means of public research to actually commercially use the new research results suitable for the market).
– *Transfer* (RSOs are regarded as an essential channel for knowledge and technology transfer, which can also stimulate the cooperation between science and the economy).
– *Diffusion* (RSOs are expected to influence the quicker dissemination of scientific knowledge and methods in the economy).

Nevertheless, empirical evidence questions the first function, since RSOs are very few in each economy, and they also tend to retain a slim organisational structure, outsourcing all the activities which are not directly related to R&D. Thus, the function of RSOs as employers should be recognised not in quantitative, but rather in qualitative terms, while providing the economy with the critical quality of intellectual resources for innovation and (both radical and incremental) technological modernisation.

The second comment on the distinction between these functions is that it refers only to a three-segment relationship chain around RSOs: parent university or public institution – research-based spin-off firm – industrial customer.

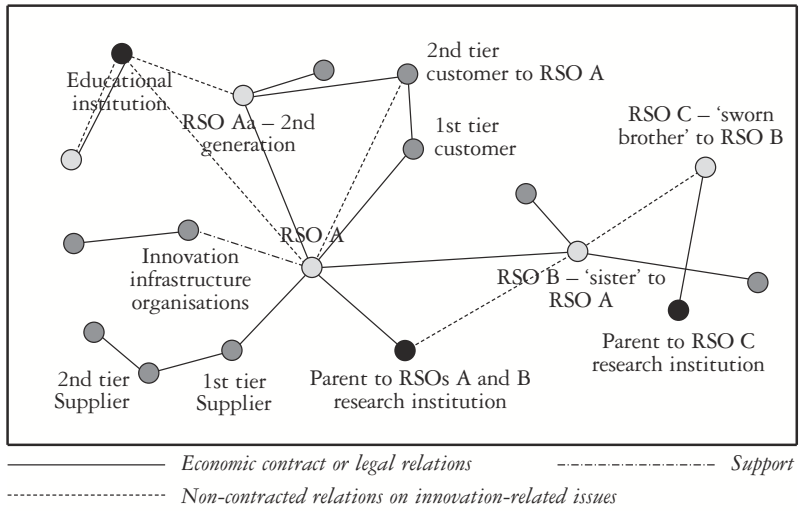
My argument is that if we extend our view of relationship types emerging around RSOs and their character and recognise the duality of these interactions, we can better understand the role of RSOs in the economy in general and in the national innovation system in particular.

It is the relationships with suppliers and customers, with parent institutions and higher educational institutions, from which RSOs recruit young staff, with organisations of innovation infrastructure (technoparks, business/incubators, technology transfer centres), and not least, with other technology-based firms, which constitute the RSO network (see Figure 1).

'Sisters' is a term applied by NUTEK to typify the new firms and implies '1 or at least two spin-offs originating from the same mother organisation in the same year, with the mother organisation surviving' (Svanfeldt & Ullstroem 2001). This term originates from corporate business, nevertheless I consider it to be very helpful in identifying RSO relationships.

One should distinguish between 'splits with no surviving mother'—firms split up with no parts qualifying as spin-offs or cleavages—and 'cleavages'—firms divided into 2 or 3 parts that would all qualify individually as survivors. For the purposes of defining *spin-offs in a similar technology area originating from different parent organisations* I found the term 'sworn brothers' to be appropriate.

Figure 1. RSO network



Having identified these relationships, it is easier to proceed with typifying these relationships in order to be able to analyse the knowledge flows and see if there are any spill-overs as assumed earlier.

Closer analysis reveals that the flows around RSOs are dialectical: RSOs are *contracting* and *subcontracting*; they *source expertise* from elsewhere; industry and parent institutes outsource *activities to them*; and second generation RSOs *source expertise* from them; and even *resource sharing* can be observed in an *ingoing* and *outgoing regime*, as they both use the infrastructure of parent institutes and render support to other RSOs themselves, when for example allowing them to access rare and expensive equipment.

Empirical results from case studies

Case studies provide us with facts on the growth of a network.

Sourcing expertise

The process of team-building often occurs on the basis of a former cooperation of the founders (at the same laboratory).

Most founders have dealt with processes forming the basis of innovations since the 1960s or 1970s (at their initial stage of development at that time). Being among the few who developed or participated in the creation of key technological innovations in the Soviet period, they became an ideological source for innovation at RSOs.

Academic entrepreneurs keep in continuous contact with their former collaborators from the parent research institute and their scientific circle; scientific conferences provide valuable help in communication and studying new prospects. An important basis for the attraction of experts are well-established contacts forged during postgraduate studies and contacts with colleagues at the institute. These contacts plus cooperation with external organisations and businessmen, and former scientific and industrial activity help in attracting qualified staff.

Beyond this, contacts with all developers in the region are established. The enterprises are frequently members of scientific societies in their technological area. Since RSOs are tackling technological issues relating to several overlapping technological fields, experts from other enterprises and research organisations are regularly involved in implementing specific jobs (for example, experts in thermal processing, design, research, technology and equipment development). In addition, collaborating structures are organised, such as temporary scientific groups, where the joint brainstorming potential of various organisations, including research institutes, is used for finding 'cross-cultural' solutions.

RSOs as sources of expertise

The young staff is trained by involving them in postgraduate work, thus providing a pool of qualified experts in a period of 3–4 years. Professional education and learning-by-doing are the most common training practices employed by the companies. A widespread problem with staff is the 'intra-

national brain drain', when other companies poach the young experts by offering more favourable financial conditions of work. In this way two 'second generation' private companies in Minsk were organised based on former employees of one RSO. Employing the parent technology, these new firms are now commercially more effective than their parent. They make use of free technologies developed in the parent RSO and draw away its customers. Seen from the national economy level, this is nevertheless a pure knowledge spill-over, which contributes directly to the dissemination of innovation and technological progress in the economy.

A common problem is the customers' staff serious lack of innovative competences required to operate complex equipment. The qualifications of workers at factories where innovative equipment is introduced, as also the level of responsibility, have proven to be largely unsatisfactory, according to respondents. Workers are therefore not able to use all useful features of the complex multipurpose installations (vacuum, laser engineering, advanced plasma technologies). That is why all RSOs involved in introducing new equipment to enterprises take the low innovative competences of customers' workers into account: alongside the introduction of new equipment, they also provide training and consulting to customers' staff throughout the one-year warranty period. The installations produced by domestic RSOs are also manufactured taking into account their future users and specific exploitation regime: they are more reliable and easier to operate.

Ingoing and outgoing resource sharing at 'roots' level

In their initial stage most RSOs only 'quasi'-depart (Radosevic 2003) from their parent research institutes, officially acting as separate entities but leasing office and production areas. In the same way, equipment is often leased from the home institute, largely because of its unique character. Some equipment components may also be leased from the parent organisation (or founder) of the company.

It is essential that 75% of Belarusian enterprises have never collaborated with scientific and research institutions (Metolit 2003). Those that did so worked primarily with public research institutes (9), the national academy of sciences (6), and—only in 4 cases—with universities. This clear preference is based chiefly on the high reputation enjoyed by the public research

sphere in Belarus, which can be used as a sound basis for the promotion of research-based spin-offs. This has also been corroborated by qualitative analyses (Gordienko et al. 2002). Moreover, having built up contacts with industrial partners based on 'parent' trademarks, spin-off firms 'pay the debt' back with their own developments (which are quicker, oriented to a highly specific demand, and relatively cheap), and industrial enterprises are more eager to cooperate with public research institutions in joint research projects in spite of a longer implementation period, since they believe in the effectiveness of such collaboration.

Ingoing and outgoing resource sharing at 'branch' level

Overlapping technologies lead to a tight integration of the elite researchers' community. There are also cases of informal technological collaboration between innovators, when firms, for example, give other RSOs access to their (unique) installations for testing purposes, or even perform such tests themselves. Sometimes RSOs even pass on installations they have developed for their own innovative technological process to 'enterprises/plants manufacturing similar products to ours' (both in Belarus and Russia)—as the researchers-innovators call them. 'They are not competitors—we collaborate; they are not able to compete, they have no experts, they are practically bankrupt, and equipment we have developed is passed on to them on a collaborative basis to help them survive'. If firms with a *similar* profile of activity exist (including in Russia or the Ukraine), cooperative relations are established with them.

The reasoning behind an RSO's search for cooperation 'with like institutions' is tripartite: (1) the corporate culture of scientists; (2) the high interdependence of technologies in the high-tech sector; (3) a rationale derived directly from the very fact of the 'monopoly' on knowledge and competence. The case of a highly promising technology without analogues in the world in terms of its technological advances might serve as an example. The core technology (nanomaterials) permits the development of a wider cluster of further high-tech spheres with their own technologies and specific production sites in many different industries (automotive, medical, chemical industries etc.). The possibilities of new technologies are so vast and the market is so unprepared to accept this spectrum and adapt it for production

that one of the major concerns confronting the innovators has been how to attract competitors who would prepare the market with simplified versions of technological processes.

Outsourcing to and from RSOs

Technological collaboration of RSOs with parent research institutions is important for the latter because overhead expenditures in large research institutes account for about 130–150% of costs involved in materialising the innovation, thus making the resultant products too expensive. Specific R&D tasks in state scientific and technological projects are frequently outsourced by parent public research institutes to their more flexible spin-offs.

Practically all RSOs strive to attain a slim organisational structure and they become ever 'fitter' over time. The average number of staff constantly employed at scientific innovation enterprises decreased from 13 persons in 1995 to 8 in 2001. Only employees constituting the core of the firm are employed permanently at the enterprise on the basis of an employment contract; they organise all the activities and innovation (R&D) work performed at the company. Individual businessmen are involved in job implementation and specific manufacturing tasks on a time basis. All of these people collaborate with the RSO on a subcontracting basis, thus creating the opportunity to cut overhead costs. This also permits a reduction of the excessive tax burdens placed on the enterprise: income tax only is payable for workers employed on a part-time basis for one-off manufacturing tasks. Additional external workers are involved in all 'non-inventive' tasks (preparation of materials, sharpening, etc.) (outsourcing). The more successful the introduction of technologies to industry (commercial success of innovation), the higher the number of ordinary workers per researcher.

Analysing relationship content: Self-reinforcement of knowledge spill-overs

Industrial customers 'database'

The linkages of scientists from higher educational establishments and scientific research institutions with industry have developed previously within the framework of specific tasks in scientific and technological pro-

grammes, separate projects, state budget and business contracts. Now this is the *knowledge of contacts*, which pre-determines the sustainability of RSO success: the linkage of science and industry occurs through joining the two networks (knowledge of 'who knows the people who know where the technological decision can be developed or who can find an application'). As mentioned above, a significant proportion of an RSO's success derives from its top manager's knowledge of who could be a potential client, supplier or scientific consultant for its area of activity.

The well-established contacts with colleagues involved in scientific activity as well as with customers and direct users of R&D results of research-based spin-off firms serve not only to attract top specialists to the company, but also to find the best organisational and financial schemes of collaboration with other researchers and with customers. Since personal contacts (and personnel mobility) are the main channel for the transfer of tacit knowledge, RSOs not only perform the R&D required, but also involve the actors and organisations from both spheres in a continuous R&D process by sharing their efforts. This all helps them to suborganise their surrounding networks—thus involving the industrial sector more closely in research. Simultaneously, this makes them a 'local' phenomenon. They are most successful when acting on the 'acquaintances' market, especially in the early phases of the enterprise. Informal social relationships, which are naturally restricted to a limited geographic area, constitute the so-called '*internal representation*', which can develop into a social network, within which a specific innovation culture is cultivated.

Lowering transactional costs

RSO managers have introduced alternative forms of cooperation, because of the different necessities and financial possibilities of their customers, these include: delivery of ready details to customers; delivery of raw material, semi-finished items for further production at customer premises; sale of licenses; adjustment of the production line; joint manufacture for internal consumption in Belarus and abroad, etc. Through *participative R&D orders execution*, i.e. involvement of customers' infrastructure and workers (for example at manufacturing enterprises) in carrying out manufacturing and assembling tasks, it is possible to reduce the cash costs of

the order, thus lowering the share of market operations in contract, reducing transactional costs and thus enabling customers to buy technological innovations.

The application of local R&D resources also reduces the transaction costs for multinational companies (MNC) in their integration into local technological and production structures. Transaction costs arise for MNCs in connection with the necessity to introduce the new technology in a 'local context' in social, economic, and political dimensions, and dovetail the technologies they employ with the local networks. Exploitation of 'local knowledge' occurs for MNCs even indirectly when acquiring the technologies (or equipment into which they are integrated) from local developers. Local technology developers possess knowledge for example, about the specifics of the resource base and logistic flows in a given environment concerning a particular technology (such deep level of knowledge is not affordable from consulting firms and represents a kind of 'know-how').

Self-reinforcing innovation activity

After having established their own production facility, academic entrepreneurs also have the possibility to conduct research on a regular basis. In many RSO companies, R&D activity has intensified compared to former research work at public research institutes, let alone universities. Each contract provides the opportunity to modify equipment if necessary, and to work out new technological regimes (by working with different alloys, processing metals with different characteristics). Their high level of dependence on customer relationships makes the process more sustainable. 'Work with customers means the requirement to provide 100% technological reliability—the thing that is wanted is not a research report to be shelved, as during former scientific practice'. The companies cannot risk producing new products and then searching for a buyer. Working to order is an objective necessity, since make-to-stock production is ruled out. First, practically no circulating assets are available—work to order can only be carried out after advance payment has been made. Second, each customer has sophisticated requirements on the style of products, the special characteristics (degrees of protection) they should provide, etc. Innovators must work for the customers' specific requirements only.

In its turn, work for a concrete customer with his sophisticated needs means that *incremental value of R&D* is added to the outcome product in practically each contract.

Conclusions: Positive path dependence

Our case studies show that thanks to the three factors

(1) continuous innovation as a mode of RSO existence,

(2) access to wide networks of contacts in both technology-creating science and technology-implementing industry, and

(3) exclusive ability to lower transactional costs both for domestic and foreign industrial consumers

the marketed and non-market (spill-overs) activities of R&D transfer reinforce each other, resulting in positive path dependence.

Another important factor for the tight integration of the elite researchers' community is the essence of high technologies where RSOs are most active, this being their highly interconnected and overlapping character.

To extend the argument even further, one could suggest that in a transition economy, but also in a developed economy, *RSOs* have an *exclusive position* in a way of fulfilling the knowledge and technology spill-over function, which derives from the RSO's ability to create value added by adjusting the technologies to the requirements of a specific technological economy structure. Thus, the knowledge and technology spill-over observed in the mutual interaction of RSOs represents an obvious mechanism to avoid the transaction costs of technology transfer (understood as the costs of using the price mechanism for transactions, as Coase 1937, in Hodgson 1993).

Opportunities for further studies remain. For instance, it seems necessary to take long-term dynamics into account when studying the 'officially unregistered' flows of knowledge and technologies from RSOs to second generation research firms and to partnering companies.

References

BMBF (2002), *Spin-off, Gründungen aus der öffentlichen Forschung in Deutschland*, Bonn: Zentrum für europäische Wirtschaftsforschungen (ZEW), Bundesministerium für Bildung und Forschung (BMBF).

Cantwell, John A. and Ram Mudambi (2003), 'On the nature of knowledge creation in MNE subsidiaries: An empirical analysis using patent data', paper presented at the DRUID Summer Conference 2003 'Creating, Sharing and Transferring Knowledge. The Role of Geography, Institutions and Organisations', June 12–14, 2003, Copenhagen.

Chesbrough, Henry (2003), 'The governance and performance of Xerox's technology spin-off companies', *Research Policy* 32: 403–421.

Coase, Ronald (1998), 'The new institutional economics', *The American Economic Review* 88 (2): 72–74.

Cohen, Wesley M., Akira Goto, Akiya Nagata, Richard R. Nelson and John P. Walsh (2002), 'R&D Spillovers? Patents and the incentives to innovate in Japan and the United States', *Research Policy* 31: 1349–1367.

Commons, John R. (1931), 'Institutional economics', *The American Economic Review* 21 (3): 648–657.

Eisenhardt, Kathleen M. (1989), 'Building theory from case studies', *Academy of Management Review* 14 (4): 532–550.

Fuentelsaz, Lucio, Jaime Gomez and Yolanda Polo (2003), 'Intrafirm diffusion of new technologies: An empirical application', *Research Policy* 32: 533–551.

Giddens, Anthony (1993), *New Rules of Sociological Method*, Cambridge: Polity Press.

Gordienko, Anatolij, Anna Pobol and Igor Pobol (2002), 'Spin-off firms around the academic institute as a form of innovation networks development in Belarus', in *Actual Issues of Innovation Activity Development. VII International Scientific and Practical Conference, Ukraine, 16–21 September 2002*, Alushta: 185–192.

Hodgson, Geoffrey M. (1993), 'Transaction costs and the evolution of the firm', in Christos Pitelis (Ed.), *Transaction Costs: Markets and Hierarchies*, Cornwall: TJ Press : 77–100.

Latour, Bruno (1999), *Pandora's Hope. Essays on the Reality of Science Studies*, Cambridge, MA/London: Harvard University Press.

Metolit (2003), *Financial and Economic Provision of Innovation Activity*, materials of a seminar on 18 December 2003, Minsk: Technopark BNTU 'Metolit'.

Narula, Rajneesh and Antonello Zanfei (2004), 'Globalisation of innovation: The role of multinational enterprises', DRUID Working Paper No. 03–15, in Jan Fagerberg, David Mowery and Richard R. Nelson (Eds.), *Handbook of Innovation*, Oxford: Oxford University Press.

North, Douglass C. (1971), 'Institutional Change and Economic Development', *The Journal of Economic History* 31 (1): 118–125.

Parhankangas, Annaleena and Pia Arenius (2003), 'From a corporate venture to an independent company: A base for a taxonomy for corporate spin-off firms', *Research Policy* 32: 463–481.

Pobol, Anna (2004), 'Financial and organisational provision of innovation activity at research-based spin-off firms in a transitive economy of Belarus', in Walter L. Filho (Ed.), *R&D Priorities in Innovation Policy and Financing in Former Socialist Countries*, IOS Press.

Radosevic, Slavo (School of Slavonic and East European Studies) (2003), Personal Communication, April 3.

Ragin, Charles C. and Howard S. Becker (1992), *What is a Case? Exploring the Foundations of Social Inquiry*, Cambridge: Cambridge University Press.

Semadeni, Matthew Briggs (2003), 'Leaving the Corporate Fold: Examining Spin-off Actions and Performance', dissertation submitted to Texas A&M University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Smallbone, David, Federika Welter, Igor Egorov and Anton Slonimski (2002), *Innovations, Small and Medium Enterprises and Economic Development in Ukraine and Belarus: A Position Paper*, Essen: Rheinisch-Westfälisches Institut für Wirtschaftsforschung.

Svanfeldt, Christian and Jonny Ullstroem (2001), 'Firm demography: Mapping firm dynamics by human resources data', in *Innovation and Enterprise Creation: Statistics and Indicators*, Proceedings of the conference held at Sophia Antipolis, 23 and 24 November 2000, Contract No: INNO-146, edited by Technopolis: B. Thuriaux, E. Arnold and C. Couchot, Directorate-General for Enterprise, EUR 17038, Luxembourg: Office for Official Publications of the European Communities.