

**A Quarterly Journal of Nowy Sacz School of Business
– National-Louis University**

TECHNOLOGY ENTREPRENEURSHIP

**Edited by
Marta Gancarczyk**

Volume 8 Issue 1

2012

The JOURNAL OF ENTREPRENEURSHIP, MANAGEMENT AND INNOVATION

is the official scientific journal published quarterly by Nowy Sacz School of Business – National-Louis University in Poland. **JEMI** is an interdisciplinary, double blind-reviewed journal, emphasizing theoretical and empirical articles in entrepreneurship, management, innovation and related fields. The journal is published both in printed form and on-line at www.jemi.edu.pl.

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The entrepreneurship area of the journal covers the three major topics: 1) venture creation and small business, 2) the impact of entrepreneurship on economic growth including local and regional development, and 3) entrepreneurial attitudes and motives. We invite original papers of theoretical and empirical nature, rooted in the disciplines of economics, management, sociology, political science, and psychology. The interdisciplinary research is encouraged to assure a comprehensive approach to the topics discussed and to advance both theory and practice.

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JEMI IS ABSTRACTED/INDEXED BY:

GALE Science in Context; Academic OneFile, Business&Company Profiles, Business and Economics Theory, General Business File ASAP, GREENR, Infotrac Custom Journals, International Business; Cabell's Directories; Directory of Open Access Journals (DOAJ); EBSCO; Google Scholar; Index Copernicus; CEJSH; Ulrichsweb; WorldCat; SSRN; ARIANTA; Electronic Journals Library; E-journals.org.

The original version: printed journal

ISSN 2299-7075 (PRINTED)

ISSN 2299-7326 (ONLINE)

Cover: Janusz Bąk

Typesetting and printed by:

Firma Usługowa FIRMA PUNKT, Katarzyna Foszcz
ul. Wróbla 16, 39-200 Dębica
tel.+48 602 693 799

Wydawnictwo i Drukarnia: NOVA SANDEC

Mariusz Kałyniuk, Roman Kałyniuk
ul. Lwowska 143, 33-300 Nowy Sacz
<http://novasandec.com>

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From the Editor

Entrepreneurial activity represents a critical link between the scientific research and implementation of the knowledge economy. The financial investment in R+D from government or private sources does not directly transfer into economic outcomes if not supported by entrepreneurial opportunity seeking and commercialization of scientific research.

This issue of JEMI discusses Technology Entrepreneurship understood as a process of establishing, growing and managing of technology-based firms (TBFs). TBFs attracted a lot of attention in the bottom-up empirical research focused on behaviours and economic role of the companies that embody the knowledge from scientific discoveries and inventions. However, there is still a need for commonly accepted conceptual framework that would identify the core properties of those companies to serve both research and policy purposes. TBFs can be defined as companies that demonstrate above average investment in research and development and above average share of R+D personnel. Moreover, they focus on technology in such aspects of functioning as market, type of innovations (specifically product and process, i.e. technological innovations) and organizational culture. These characteristics do not restrict technology firms to high technology sectors, even if they prevalingly belong to them, but they can be found in all the sectors. By providing innovative products, services and processes, they create new markets and opportunities for high value-added jobs, stimulate efficiency in all economic sectors, effectively compete in the international arena and contribute to exporting. On the other hand, the activity of technology entrepreneurs is challenging, being exposed to a number of risks in terms of return to R+D investment, success of new product commercialization, market acceptance of new solutions and of severe competition from high-class international rivals.

The articles included in this issue offer valuable insights into the Technology Entrepreneurship as an economic phenomenon and object of research. The Authors' contributions are directed at three major areas in the functioning of technology-based firms, namely: 1) strategies in technology entrepreneurship, 2) academic entrepreneurship and 3) conditions for technology development including organizational innovations and regional factors of company growth.

The first thematic block discusses the strategies of TBFs as focused on managing risks in R+D competition. The contributions propose an important observation on technology competition as not purely based on uniqueness, qualities of engineering and research laboratory efforts but dependent on the entrepreneurial approach to market and competitive environment. Krzysztof Klinecicz develops a comprehensive analysis of political alliances as instrumental to the success in commercialization of Microsoft's and Google's technologies. Based on research review and own empirical findings,

Milena Ratajczak-Mrozek studies the global networking activity of high-technology enterprises to source the external knowledge and to collaborate in innovative undertakings. Marta Najda-Janoszka points to rarely described phenomenon of imitative approach combined with entrepreneurial orientation in the companies from high-tech sectors, which are normally attributed a breakthrough innovative approach.

The second thematic block presents the core, determinants and assessment of development prospects for academic entrepreneurship from the two distant contexts – Poland and Malaysia. Irena Łącka presents the essence of technology transfer as a point of departure for highlighting the core and importance of academic entrepreneurship. Those considerations are followed by case study analyses of academic enterprises and university-business cooperation in Poland. Mohar Yusof, Mohammad Saeed Siddiq, and Leilanie Mohd Nor investigate the dependence between organizational factors at four Malaysian universities and entrepreneurial behaviour of academic staff. They find organizational culture, human resource management, leadership and control systems impacting the level of academic entrepreneurship in the universities under study.

In the third thematic block, the Authors point to important conditions for the emergence of technological innovations and the knowledge economy. Csaba Makó, Miklós Illéssy and Péter Csizmadia focus on non-technological, workplace (or organisational) innovations in Hungary. By studying cross-country comparative surveys they find the evidence of declining organizational innovations in Hungary. The authors stress the importance of workplace innovations for exploiting other type of company innovations, including technological ones. The analysis is supported with a comprehensive perspective on post-socialist countries vs. developed market economies. Zofia Łuczka and Paweł Przepióra investigate relationships between regional factors and development of small and medium-sized enterprises. After review of the literature in this field they found difficulty in identifying a general and consistent set of regional determinants of SME growth. According to their econometric model of regional determinants of SMEs' efficiency in Poland (2003-2008), the major factors are represented by R+D expenses and the level of wages, i.e. they proved generally positive relationship between the investment in technology and company growth.

We thank the Authors and Reviewers for their contributions and we believe that JEMI issue in Technology Entrepreneurship will be of relevance both for researchers, entrepreneurs, students and policy-makers.

Marta Gancarczyk

Co-Editor in Entrepreneurship, JEMI

Political Perspective on Technology Alliances – the Cases of Microsoft and Google

*Krzysztof Klincewicz**

Abstract

The article presents technological alliances as political activities, helping establish coalitions, co-opt supporters and eliminate rivals. Using the example of Microsoft's and Google's partner ecosystems, it discusses specific partnership techniques and their relevance for technology companies. The article offers a rich picture of developments of Microsoft Windows and Google Android platforms, combined with the steps taken by both companies to ensure support from partner firms. The effectiveness of financial, marketing and technological incentives as well as of deterrents depends on expected outcomes (such as: decreasing transaction costs, creating lock-ins, stimulating innovativeness or restricting development of competitive products) and technology life cycle stages. The article helps shape partnership strategies and optimize investments, needed to motivate and control partners.

Keywords: technological alliances, partners management, political perspective, Microsoft, Google

Introduction

Traditional approaches to alliances emphasize their cooperative aspects: combination of resources, leading to innovation and efficiency improvements. However, networks of firms are formed in political processes, balancing interests of various parties, and inter-organizational relations are often dominated by power struggles. The political perspective interprets organizations as entities with members pursuing their own, potentially conflicting interests, and with a limited number of actors coordinating scarce resources, thus establishing asymmetries in power (Astley & Zajac, 1991; Elg & Johansson, 1997; McLoughlin et al., 2001). In alliances, dominant firms defend and exploit their positions, while smaller partners attempt to reduce their dependencies.

The dynamic view of alliances which evolve over time focuses on joint problem solving and the gradual emergence of trust among partners (Ring & Van de Ven, 1994; Das & Teng, 2002). At different stages of the partnership process, formal elements such as bargaining, contract fulfillment and role interactions are complemented

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by informal sense making, psychological contract and interpersonal relations, thus creating opportunities to use social influence mechanisms. Firms use multiple direct mechanisms, influencing other players and making them follow a firm's desired actions (Elg & Johansson, 1997, p. 364; Avakian, 1999):

- inducement – involving motivational investments, rewarding loyal partners;
- coercion – worsening of a party's situation unless it selects the suggested alternative, e.g. by restricting access to specific resources, or threatening to compete;
- obligation – binding the opponent to make him follow an intended course of action;
- persuasion – presenting rational or emotional appeals.

Firms controlling key technologies can maintain their dominant positions not only because of superior technologies and compelling strategic visions, but also thanks to the incorporation of political actions into their business models (Avakian, 1999, pp. 43-45). Power does not need to be linked to resources possessed by an organization – it can result from specific relations or social structures (Astley & Zajac, 1991, p. 403; McLoughlin et al., 2001, p. 281). Political process consists of both observable moves (*surface politics*), as well as subtle activities, not directly involving exchanges of resources, e.g. by preventing issues from being discussed and decisions from being made (*deep structure politics*) (Elg & Johansson, 1997, pp. 365-366).

The article will apply the political perspective to explain how a technology firm can use a broad portfolio of political “tools” to manage its partners. The political power of a company helps establish and successfully defend a technological standard (Anderson & Tushman, 1990). By managing technological platforms (Cusumano & Gawer, 2002) and ecosystems of partners (Iansiti & Levien, 2004), companies may promote their standards among complementors and customers. The prevalent perspective on alliances suggests that in an alliance, a partner contributing more resources has more chances to control the other party – but the following discussion will demonstrate that intelligent use of political tactics can reduce the need for tangible contributions.

Political sociology offers a useful analogy to the dynamics of high-tech industry: the Medici family exercised power in the renaissance Florence through networks or relations and interlocking interests without holding any official government positions, and the style of exercising power can be compared to the game of chess, where successful strategies involve locking-in other players, restricting their options and making them pursue strategies convenient for the winner. The phenomenon is described as *blockmodel*, with multiple ties restricting the choices of other players, including marriages, business partnerships, real estate ownership, personal loans and other obligations (Padgett & Ansell, 1993). This heritage of political sociology will help understand the phenomenon of strategic interlocks by high-tech companies, using incentives and deterrents to induce and maintain partner loyalty.

Research problem

The article overviews political techniques, which can be used by companies intending to establish and maintain technological dominance. The research is rooted in a complex qualitative analysis of analyses Microsoft's activities in multiple markets and through various groups of partners, with particular focus on the establishment of Microsoft Windows platform. It will further present corresponding actions taken by Google, following the footsteps of Microsoft in an attempt to promote its new operating system Android.

Microsoft is one of the largest high-tech companies, leading in multiple ecosystems – it partnered in 2007 with more than half a million companies, employing 42% of the global IT workforce (IDC, 2007). Popular literature presents the company as an unscrupulous player, and the image was reinforced by numerous legal disputes and widely criticized technological decisions. On the other hand, Microsoft managed to successfully diversify from its original product - operating system – by entering various emerging markets such as business applications, telecommunications software, multimedia players and computer games. This richness of experiences helped Microsoft develop a unique combination of partner management techniques, so far unmatched by industry rivals. Microsoft was probably the first software company seriously appreciating the role of complementors. Its partnership and certification programs were imitated by other companies, but the actual partner management framework consists of various elements overlooked by imitators. The following sections will outline the techniques applied by Microsoft, differentiating between incentives and deterrents, jointly used to motivate partners and to restrict their potential opportunism. Subsequently, the framework will be applied to present relevant actions taken by Google.

Research methods

Alliances should not be regarded as discrete events but rather processes and for strategy makers, alliance dynamics is more important than initial agreements. As the article discusses a complex and yet unexplored phenomenon, it adopts a case study approach based on qualitative data analysis. The Microsoft analysis was based on over 1,600 documentary sources, including IT press articles, industry analyst reports, interviews, corporate communication and documents of courts and regulatory bodies. They covered years 1994-2004 – a period of Microsoft's domination in personal and enterprise computing. The documents were coded and analyzed in qualitative data analysis software *NVivo*, which supported the subsequent theory modeling and testing in line with the methodological recommendations of the grounded theory approach. The subsequent analysis of Google was also based on secondary data, covering a more recent period of 2007-2011. The comparison of political actions taken by the two companies in different time periods supports data triangulation and strengthens the potential for generalization of research conclusions.

Research findings – Microsoft’s use of political techniques

The analysis demonstrated repetitive use of specific partnership techniques – they were applied by Microsoft to various groups of partners and technologies. The portfolio of techniques is summarized in Figure 1 and its detailed discussion is presented in the following sections.



Figure 1. Partnership techniques used by Microsoft

Financial incentives

Minority investments

Academic literature discusses the trade-off between acquisitions and strategic alliances (Roberts & Liu, 2001; Dyer et al., 2004; Kale & Puranam, 2004), but for Microsoft, financial investments and alliances seemed to be independent phenomena. Equity investment helps implement product strategies by tying partners and inducing reciprocity, and possible motives include:

- return on investment,
- *payola*,
- control over partners strategies,
- access to resources,
- signaling function.

Minority shareholding differs from an acquisition – the investment becomes a partnership technique, focused on generating added value from the ecosystem. Investments in technology start-ups are particularly risky – instead of venture capitalist logic, Microsoft was investing in partner companies to stimulate technology diffusion - firms were paid to develop products complementing Microsoft's technology platforms. This approach seems to be particularly effective for competence-destroying innovations, usually opposed by affected companies (Anderson & Tushman, 1990, p. 612), as cash inducement helps align their strategies. First providers of complementary products must receive financial incentives to solve the “chicken-and-egg” problem: if there is no installed user base, companies are not willing to invest in the development of compatible products, but users would not buy solutions without available complementary goods (Hill, 1997).

The investment can also block and „convert” a hostile firm – for example, Microsoft co-opted Infolmage and Interliant, important partners of its competitor Lotus IBM, by offering them financial benefits and technical opportunities (Deckmyn, 1999, 2000). According to an analyst, “whereas once a company may have had its own agenda and been marching towards its own goals, an injection of Microsoft money meant that the company was turned around and had begun marching in Microsoft’s direction” (Avakian, 1997, p. 47). In order to penetrate the emerging software markets for telecommunications, television and Internet providers, Microsoft in 1999-2001 placed investments in 29 client companies in value of over 9 billion dollars (Klincewicz, 2005, p. 115). Welfare economics introduced the term *payola* to describe situations, when a party is “paid to play” - support or promote specific products. The term was originally applied to radio stations, receiving payments from record companies for airing songs (Coase, 1979), but relates to other settings, when a party is “bribed” to support specific products. Among high-tech companies, struggling to establish own standards, *payola* plays important strategic role, helping buy users or supporters.

Microsoft used financial investments to settle patent and trade secret disputes. It invested in Stac Electronics, putting an end to controversies concerning use of its compression technology in Microsoft DOS (Johnston, 1994). Later investments in competitors such as Wang Laboratories, Apple Computers and Inprise (Borland) were combined with dispute-settling technology licensing agreements (Ouellette & Weinberg, 1995).

Microsoft's investments alone did not guarantee the loyalty of partners - most evident examples of such disappointments are: Internet content provider Individual, partnering with Microsoft’s rival Netscape, and multimedia streaming specialist Real Networks, pursuing its own competitive strategy (Evers & McMillan, 2003).

Access to unique resources could be a motive for minority investments, but effective control over technologies is possible only through majority shareholding or complete acquisitions, and non-equity based alliances might offer better synergies (Dyer et al., 2004, p. 111-114). When Microsoft was preparing the launch of video game console Xbox, it acquired or invested in multiple game developer firms, and later supplemented the group by one of the largest specialists, Rare (Becker, 2002). The investments seemed to be the only plausible way to guarantee the supply of a satisfactory number of games in short time - a month after the Xbox release in 2001, 38 games were available, most of them developed specifically for the new platform (Weinstein, 2001).

Minority investments became a formalized ritual, not only offering the partners money, but more importantly, endorsing them as trusted complementors, as association with Microsoft could be a strong selling point. A demise of trust in mutual relations could in turn lead to de-investment as in the case of selling off shares of Real Networks, which dared to testify in court against Microsoft (Nash, 1998). The signaling role of marginal investments cannot be overestimated – for example, by providing financial support to former competitors, Microsoft was demonstrating its dominant power and announcing radical changes to the industry, sending a message to customers, and showing which company enjoys financial health bright future visions.

Direct financial transfers

Over the years, Microsoft perfected its portfolio of non-equity based financial incentives through direct and indirect transfers. They effectively replaced shareholding and helped provide funds for partners without the need to report it to shareholders. The available forms included **joint development projects** (with shared risk and resource input), **subcontracted development work** (one-directional payment, offering revenue opportunities to the partner) or **ordering partner's services and products for internal purposes**.

Joint ventures among key players in the converging computing, communications and media industries were frequent in the 1990s, even though their effectiveness is sometimes questionable. For example, due to its efforts to enter the emerging mobile data services segment, Microsoft established in 1998-2000 joint-ventures with the US telecommunications technology vendor Qualcomm, Japanese operator NTT DoCoMo and Swedish telecom giant Ericsson. None of them bore tangible fruits, all were later dissolved or internalized by partners, and Microsoft's contributions turned out to be worthless in the end. However, a more careful investigation shows that the ventures played an important blocking role. NTT DoCoMo did not select preferred operating system for cellular phones until 2003, leaving room for Microsoft's technologies. Ericsson committed to use Microsoft Mobile Explorer as phone web browser. Qualcomm decided to halt developments of Eudora mail server, competitor of Microsoft Exchange. In 2000, Microsoft formed a joint-venture Avanade with Andersen Consulting, employing thousands of consultants dedicated solely to Microsoft-based solutions, instrumental in positioning Windows as the platform for enterprise-wide applications (Dash, 2000).

Subcontracted development projects are traditionally used to outsource non-core tasks, either requiring specific skills (e.g. development and maintenance of spell checker module, not related to other product technologies, while requiring a sound knowledge of linguistics), or time-consuming yet not sophisticated (e.g. software testing based on predefined procedures). Microsoft case revealed the popularity of another type of subcontracting, concerning complementary solutions, where Microsoft paid a third-party for development, in line with the model of *payola*. The practice was initiated by “buying” support for Windows NT – contracting various firms (including Tandem Computers, Digital Equipment Corporation and Banyan Systems) to work on integration between Windows and their own platforms, so that they could also benefit from selling these connectors and migration services. The companies were probably not sufficiently motivated to work on adequate technologies, as the costly development would simultaneously decrease installed bases of their own platforms – payments from Microsoft helped overcome the fears and spelled a prolonged death sentence to the other platforms. The same approach supported diffusion of other technologies – Microsoft contracted in 1999 Transvirtual Technologies (Sliwa, 1999) and ActiveState Tool Corporation (Shankland, 1999) to develop Microsoft-compliant software for rival platforms. The company was from time to time using the development contracts also for other reasons: to help financially troubled companies, which it partly owned (e.g. Internet providers UUNet Technologies and XO Communications), or to fight political battles (SCO Group sued Linux community members for copyright infringement and Microsoft infused SCO with cash through a sizeable licensing agreement).

An innovative aspect of Microsoft’s strategy was a close integration between procurement processes and the partnership program. Every large company needs to rely on third parties for IT infrastructure and support services, but Microsoft was selecting solutions not only technically superior, but also “politically correct”. Purchasing decisions functioned as both endorsements for partners, as well as implicit pressure mechanisms, and historical analysis of Microsoft’s relations with partners proves a surprising co-occurrence of orders for internal use and certain commitments by suppliers. Evidence made public in Microsoft-related litigations and lawsuits indicated the subtle but categorical tone in negotiations with hardware makers or other partners - incentives offered were accompanied by implicitly expected reciprocity. Large service contracts to support Microsoft’s IT infrastructure were key motivators for Digital, Compaq and HP since 1994, and every renewal of the contract was followed by new commitments from the service provider. Microsoft’s decision to implement SAP’s financial software for internal purposes made SAP support relevant Microsoft technologies (Cafasso, 1994). The purchase of Computer Associates InocuLAN antivirus software coincided with an alignment of the CA’s strategy around Windows platform (Golde, 1997). A contract for the Internet provision for Microsoft’s portal MSN, awarded to MCI, was synchronized with MCI’s migration to Microsoft platforms, purchase of licenses and commitment to promote the standards to telecoms customers (Wong, 1997).

The multiplicity of direct financial transfers in use suggests that Microsoft had a systemic approach to partners, not focusing on single transactions but rather on a broad network of interdependencies. Payments inefficient from the perspective of financial management were crucial in gaining support for emerging technologies, but convincing competitors to become your complementors is difficult and costly.

Paying other companies for working with Windows was not sufficient. The companies had their distinctive competencies and products, so the “partnership package” had to include strategic visions and migration paths for existing technologies, helping convert the companies into reliable partners, and convincing them that they could play equally important and profitable roles in the new market. The strategy was unique, as usually vendors of disruptive technologies focus on surpassing and eliminating incumbents (Christensen, 2000) – while Microsoft invited incumbents to join the disruptor’s team, without a need to jettison what was precious to them.

Indirect financial transfers

Indirect financial transfers include investments through third-parties or decreasing partners’ costs at the company’s expense. The dedication of resources through an assignment of employees, adjustment of administrative procedures or purchase of dedicated equipment can be interpreted as investment in partners (Rokkan et al., 2003).

Microsoft was able to link capital seekers with appropriate funding sources, including venture capital firms or trusted partners such as Compaq or Intel. The mechanism was based on informal personal relations among Microsoft’s directors and investor representatives – for example, Microsoft helped SCO Group receive investment from a venture fund BayCapital Star, by convincingly presenting SCO’s prospects in relation to Microsoft’s strategy (McMillan & Evers, 2004). In order to stimulate the development of complementary solutions for Microsoft .Net platform, the company established Investor Connection program, working with venture funds to offer their customers infrastructure, access to knowledge and technical support (Luening, 2001). Such links could increase the credibility of technology start-ups, increasing their valuation and the availability of funds. Research confirms social embeddedness of transactions between institutional capital suppliers and their clients (Uzzi, 1999), and close ties with significant third-parties function as important endorsements (Gulati and Higgins, 2003).

Techniques decreasing partner’s transaction costs might be even more attractive for partners. They include: pricing the access to technology (licenses or training), providing reference product designs and supporting marketing activities. Microsoft was providing selected trusted partners with royalty-free source code, attractively priced developer tools and subsidized training – the deviations from standard pricelists were adopted at the company’s discretion, promoting businesses of preferred partners. Attractiveness of these offers was changing over time: the first large system

integration partner Digital was offered free training for 1,500 engineers (Goldberg & Bozman, 1995), while next service partners were granted less convenient commercial terms of the knowledge transfer. Correspondingly, changes to the official pricing and licensing policies were used to influence partners' strategies. The 1997 release of Microsoft Money, personal finance program, turned banks – so far customers – into partners, selling the software to own clients (MacDonald, 1997). In 2001 Microsoft showed support for the emerging Application Service Providers market by modifying its licensing model so that ASPs did not have to pay upfront for software rentals (Vijayan, 2001). The power of pricing arguments is best evidenced by the case of IBM: while negotiating a licensing deal to install Windows 95 on IBM PCs, Microsoft demanded IBM to delay the release of IBM's Lotus Smart Suite, competing with Microsoft Office, and IBM's refusal resulted in increased royalties the company had to pay for Windows (Wasserman, 1998).

Attractive pricing of technologies helps penetrate the market by discouraging other companies from developing comparable, competing functionality (Avakian, 1999, p. 45). This approach helped Microsoft establish its position among PC makers with DOS in the 1980s – hardware firms enjoyed the overall cost reduction and abandoned own investments in the operating system area, becoming locked-in by the technology. Penetration pricing of emerging technologies can be justified by learning effects and economies of scale, leading to subsequent dramatic decrease of unit costs, which compensate for the initial losses (Hill, 1997, p. 16).

The tradition of providing product reference designs is rooted in the software business, where tools, pre-defined templates and code samples were critical in gaining a wide-spread acceptance among the developer community. Microsoft adopted a corresponding approach to the hardware market. In the 1990s, it worked closely with component and device makers to reduce prices of Windows hardware, acknowledging the importance of hardware costs for software diffusion. Later it started contracting third-parties to design prototype devices, offered jointly with Microsoft software to hardware partners. Owing to the arrangement, hardware makers no longer need to conduct own R&D in the concerned areas, using reference designs provided by Microsoft and dedicated contract manufacturers. The provision of reference designs helps boost adoption of new technologies both in software and hardware markets – but if applied creatively, it can also outstrip partners of their competencies and successfully lock-in by making dependent on technological standards.

Marketing incentives

Promotion

The most common partner incentive used by high-tech companies is joint promotion, done either by transferring funds to partners, or running campaigns with them. Owing to the scale of operations, Microsoft was able to run global campaigns, re-using designs and know-how. The preparation of marketing templates, scripts and manuals

is also a form of investment in the partner community, reducing the necessary cost for partners interested in running a campaign. Microsoft offers the incentives to committed, certified partners, who have demonstrated the importance of the link by investing in establishing skills and designing own products in relevant ways (Microsoft's partnership program formalizes the rules, indicating conditions entitling to specific types of marketing and business support). Joint promotion is additionally attractive for partners, as it extends the appeal of Microsoft's brand to their certified products – for example, a marketing campaign “Plays for Sure”, launched in 2004 by Microsoft, promoted partner multimedia devices compliant with Microsoft's standard (Borland, 1994).

Sales

Microsoft was reinforcing results of joint promotions by corresponding sales activities. The company established special sales channels for partners. Windows 95 with Internet Explorer offered a unique way of contracting Internet Service Provider - Microsoft hosted „Internet Referrals Server” with a list of authorized ISPs, and customers clicking on the Internet icon were able to select one to setup the connection (Pelline, 1996). This is one of many examples of product bundling, a practice typical for Microsoft, and frequently criticized by anti-trust authorities. However, the legal criticism concerned the bundling of own products to undermine sales opportunities of competitors, while here the innovative platform design helped Microsoft offer sales-related incentives to selected partners, benefiting from Windows user base.

Microsoft was also bundling complementary goods, improving own platform and offering sales opportunities to partners. Examples include: Macromedia Shockwave (animation viewer bundled with Internet Explorer, supplemented by commercial tools for creating the media files, sold by Macromedia) (Ricciuti, 1996), Symantec WinFax (offered with Outlook to send basic faxes, upgradeable to full version) (Luening, 1998) or Crystal Enterprise (reporting module for Microsoft CRM, with a paid upgrade for more specialist reports) (Cowley, 2002). Partners had twofold revenue opportunities: initial payment for the bundled component from Microsoft, and sales of related upgrades. Moreover, some cases involved *symbolic bundling*, when Microsoft embedded non-critical components from a partner with the sole purpose of promoting the partnership and rewarding the loyal company – for example, Windows 2000 included minor utility software from Computer Associates' Unicenter solution, and CA was able to position Unicenter as the recommended solution for this operating system (Heskett, 1998).

Microsoft was one of the first high-tech companies that made own sales representatives responsible for the sales of partner products - their targets involved of course also sales of relevant Microsoft licenses, pulled through by partner solutions. For example, an implementation of a specialist business solution requires Windows and SQL Server database licenses, and the deal may be equally profitable to Microsoft and partners, while the partner application is needed to sell the underlying platform. Microsoft's sales strategy is based on “go-to-market” initiatives, where account

managers work with key customers in a vertical market, offering them complex business packages, consisting of Microsoft's and third-party products, accompanied by implementation services from a reliable partner. Instead of selling off-the-shelf software such as Windows or Office, Microsoft considers how these products can add value and address customers' problems. Customers of Microsoft platform form target markets for partners, using Microsoft-controlled communication channels – and Microsoft benefits from the availability of new value-adding solutions for these customers.

Positioning own products

An important incentive, promoting the openness in partner relations, is the positioning of own products. Microsoft frequently positioned them as complementary or inferior to partner solutions. When releasing new products in domains previously controlled by partners, Microsoft was convincing the affected partners to cooperate and supplement the offering, even if the products were posing considerable threats to their businesses. For example, Microsoft entered document management market with SharePoint Portal Server – its first version was positioned as collaboration portal for teams and departments, gaining support from major document management vendors, and the second version was released as a scalable platform for managing documents, competing with the incumbent solutions, but partners remained loyal and supportive. Similarly, Microsoft's plan to enter CRM market was opposed by many partners – CRM specialists, perceiving it as a direct threat, but the company promoted the new product among small and medium-size organizations only. Microsoft is capable of successfully partnering with key players in specific product areas, while developing own competing solutions – the partners try in turn to benefit from the time left to them and penetrate the Microsoft customer base before becoming competitors.

Microsoft's approach resembles historical *salami tactics*. Hungarian communist Rákosi compared the ways of dealing away with opposition to slicing the salami – slowly cutting thin slices until the entire sausage is chopped without protests. The salami metaphor emphasizes hidden agendas and crafty character of the product marketing process: intentional positioning of own products as inferior to keep potential competitors confident, and later striking them by revealing the actual potential of a product.

Certification

Certification programs offer affiliation with the dominant player's brand. They assure customers about potential benefits of partner solutions, their compatibility with technology platforms and design, based on recent standards and best practices. Microsoft adopted two certification frameworks – for partner companies and for their products. Partner certification is linked to professional training and examination, and partners are required to employ a prescribed number of engineers specializing in Microsoft technologies. Product certification refers to solution architecture and features, and is awarded after independent technical tests. Customers working with

a certified Microsoft partner can expect the company to possess adequate technical skills, while their decision to purchase products certified as compliant with certain platforms is based on implicit guarantees of product quality – certifications perform important signaling functions in complex markets as it differentiates suppliers. Microsoft introduced multiple partnership levels – although the partnership program rules are formalized, they are not audited by third parties, so it is at Microsoft's discretion to promote a specific partner to a higher status, thus offering yet another instrument of power. Similarly for certified products, Microsoft tends to select some of many comparable partner solutions to include them in “go-to-market” initiatives, deliberately promoting the most loyal partners, who do not offer solutions for competitive operating system or database platforms.

Apart from the benefits, partnership programs are troublesome to partners: they require substantial investments in training and certification, especially as Microsoft regularly overhauls the curricula, requiring companies to upgrade their knowledge once new technologies are released, while product certification is costly: testing is a paid service, and product development must comply with Microsoft standards and development methods.

Technological incentives

Platform management

Microsoft offers a seminal example of platform management (Cusumano & Gawer, 2002): offering software layer, on top of which third-parties can build own solutions. Partner products become technically dependent on the platform, and could not be implemented in a stand-alone mode. Partners are aware of the dependency, carefully weighting arguments before they decide to support a specific technology, and Microsoft has to guarantee the continuous development and migration paths between technology versions. For example, when managing the transition from 16- to 32-bit Windows, the firm had to minimize the technology's impact on partners, investing to make it backwards-compatible. Third-party projects require the platform openness, with programming interfaces and development tools – Microsoft was offering them for Windows, and later started designing other products in similar ways. The platform strategy involves substantial investments in technology development – power in partner relations is inextricably linked to responsibility.

Partner-oriented product development

In order to gain support for its platform, Microsoft had to design it in ways compliant with partner products. This required a good understanding of partners' needs, specificity of their solutions and future directions of technology development. Every release of Windows included support for specific processors, hardware (with drivers for peripheral devices, updated and tested by Microsoft) and software. Software integration was also helpful in penetrating user bases of competitors – as in the cases

of document import-export filters for text editor WordPerfect in Microsoft Word, and connectors to products from Oracle, Sun, Lotus or Novell.

Partner-oriented development is also evidenced by involvement in standard setting initiatives, extending beyond Microsoft's core competences. It pursued hardware-related projects with partners to establish new standards and support them in Windows – examples include: Plug-and-Play interface (automatic recognition and configuration of peripherals), computer standardization projects with Intel, Compaq and ARM, focused on reducing the manufacturing cost and optimizing performance, early support for emerging standards such as USB, FireWire and WiFi. Microsoft implemented also software interfaces, enabling interoperability of multiple software systems in Windows environment. The complementary nature of high-tech products made in many cases the partner-oriented development a necessity – when Microsoft wanted to enter the business-to-business market with transaction processing platform BizTalk, it offered connectors to four major online exchanges from Ariba, CommerceOne, Clarus and VerticalNet, investing in development of connectors but gaining access to potential customers (Sliwa, 2000).

Product inferiority

New products may initially not be appealing to mainstream customers, but by gradually improving performance they can substitute previous alternatives (Christensen, 2000). Their inferiority results from the nature of technology development cycles, where disruptive technologies are catching up with incumbents. Microsoft offers however examples of a more sophisticated approach, based on *intentional inferiority*. The company was liaising with partners, keeping low profile of certain products, for which partner-made counterparts existed. By deliberately halting the development of own components, it offered “grace periods” for partner applications. Microsoft DOS included antivirus functionality, but in Windows, the company decided to leave this domain to partners (Johnston, 1995). When releasing Windows XP in 2001, Microsoft wanted to offer sales opportunities to existing media software partners, especially as the system bundled various features previously contributing to their revenues – the company decided not to offer DVD playback and MP3 ripping functionality, promoting add-ins from CyberLink, InterVideo and Ravisent (Wilcox, 2001a). Online shop MSN Music did not exploit all technically available opportunities – Microsoft intentionally left time-limited music rentals and monthly subscriptions to partners and restricted own sales to pay-per-song downloads. Intentional inferiority could be dangerous for partners, lulling them into security, while the decision not to develop certain functionality could easily be changed: after some time, Microsoft released own antivirus software, started offering DVD and MP3 support in Windows and adopted new pricing models for Internet music. Nevertheless, the intentional inferiority offers at least temporary revenue opportunities for partners, becoming an important technical incentive in strategic alliances.

Knowledge transfer

Training, technical documentation and dedicated support help transfer specialist knowledge to partners and enable them to build own solutions. These activities can be a revenue opportunity or a form of investment, and many firms are indecisive as to whether they should focus on cashing from partners, or establishing long-term advantage by investing to build the partner's competences and boost diffusion of own products. For mature companies, revenues driven by customer projects implemented jointly with partners seem more promising than earning money merely from partners, and partner training events are often delivered at cost or even below cost. Microsoft's experiences demonstrate the benefits of flexible pricing of knowledge transfer – the company was willing to cover all costs for first partners, needed to gain the critical mass for new technologies (for example, 1,500 of Digital employees were trained at Microsoft's expense (Goldberg & Bozman, 1995)), and large partners were offered attractive commercial conditions in return for their commitments to product development, support and employee certification.

Knowledge transfer for partners can therefore be interpreted as resulting from interplay between four possible motives:

- financial motive – offering revenue for the company, either direct, or indirect (as partners are expected to sell more effectively);
- technological motive – supplementing technology platforms by complementary products and professional implementation services;
- commitment motive – inducing partner loyalty and reciprocity, when the company indirectly invests in a partner by covering costs, or the partner makes relation-specific investments in training and certification, later limiting opportunism, as investments generate sunk costs once the relationship is terminated (Wathne & Heide, 2000);
- marketing motive – by signaling partner competencies to customers and growing support for own platform - for example, partnership with one of the largest system integrator EDS was critical to the successful introduction of Windows, as large customers were often disappointed by the quality of Microsoft technical support, and addition of 7,000 experienced service professionals from EDS was a move welcome by the market (Cole-Gomolski, 1999).

Discretionary financing of activities helps influence the strategies of partners and should be managed as part of a comprehensive partnership program. Requiring partners to make own investments in training and certification facilitates in turn their self-selection into the relationships, as they have to prove willingness to bear the costs and efforts (Wathne & Heide, 2000). Knowledge transfer activities include not only training, but also assignment of own technical specialists, who work with partners on specific sales or development projects, help design solutions, and evaluate technologies or marketing plans. In the case of Microsoft, distinctive corporate culture facilitates joint projects even when not every aspect is governed by non-disclosure agreements, enabling informal access to information and decision makers.

Learning by doing

Learning by doing is an important technical incentive for partners, enabling them to experiment with technologies and build relevant competencies. Tacit knowledge, which is particularly important for technology projects, can only be acquired in action and cannot be substituted by even best formal training or documentation. For emerging technologies and new product platforms, Microsoft helped partners acquire necessary skills by offering learning opportunities through contracted projects, joint development and supply of specialist services for internal use, enabling them to subsequently approach customers and demonstrate own proficiency and references. These projects had thus three parallel functions:

- financial – being an incentive for partners;
- tangible – delivering specific technical outcomes, useful for Microsoft's operations or technology development;
- intangible – helping partners learn to better know the platform and be able to deliver solutions for customers.

Joint partner projects, focused on the establishment of new standards, were also intended to build a reliable complementor and service provider base for Microsoft technologies. An alliance with the networking giant Cisco Systems offered specialist contribution to Active Directory included in Windows, but also improved Cisco's understanding of the platform (DiDio, 1997). Multimedia format ASF was developed by Microsoft-led coalition of software and media companies such as Adobe Systems, Avid Technology, Digidesign, Pinnacle Systems, Softimage, Sonic Foundry and Truevision, which built their own compatible product lines (Busse, 1998).

Stimulating knowledge generation

Knowledge and skills in new technology-related areas do not need to be transferred directly by the platform owner – the company may become knowledge facilitator. Microsoft established partner community, in which partners were able to achieve additional synergies, contributing to the diffusion of technologies. These activities can be compared to a “bazaar”, where other market participants meet and cooperate (Gulati, 1995), as personal interactions and inter-organizational dynamics play vital roles in creation and distribution of knowledge. Microsoft runs regular events for partners and individual developers, stimulating networking among business and technical people. The company uses Internet to support virtual communities through self-support online discussion groups, chat rooms and wikis on a website named Channel9 (Evers, 2004).

To further stimulate knowledge generation, Microsoft thinks about strategies *for* partners. It seems to apply the competency management perspective not only internally, but also to businesses of other firms, identifying their core competences and planning their evolution in parallel to the development of Microsoft's products. Trusted partners benefited from repeated ties, working with the software giant on many projects and thus improving own skills – for example, in hardware area, Microsoft

partnered with the same companies on the development of respectively handheld and tablet computers, smartphones, Media Center PCs and portable media players. All devices shared common components, while each product category had also features, requiring new technical expertise – Microsoft’s partners could thus re-use some knowledge, and supplement it by new elements. This approach helps reduce potential resistance of partners and shorten the technology adoption process by showing that the promoted innovations are competence-enhancing (Anderson and Tushman, 1990, p. 612). As the response of the community of practitioners is critical for the commercial success of new technologies, Microsoft took the initiative to facilitate communication and thus influence perceptions and technology decisions.

Technical privileging

Even though Microsoft technologies seemed open for interested parties, the control of proprietary technical standards enabled Microsoft to privilege or disadvantage individual partners. Exclusivity, traditionally used in other business sectors, does not seem a plausible contractual means in the high-tech industry, where knowledge spillovers are difficult to prevent, and restricting clauses questioned by antitrust authorities.

Instead, the company restricted access to specialist technological knowledge in more creative ways. Standard developer tools, documentation and code samples were often not sufficient for partners developing certain solutions. For example, toolkits for Unix-Windows applications porting, written by Microsoft partners in the 1990s, required access to the actual Windows source code. The case of Bristol Technologies shows the real bargaining power of Microsoft. After several years of successful cooperation, Bristol was denied access to the code (or rather required to sign a revised, unfavorable contract), and had to give up the product development (Sykes, 1998). Similarly, not all programming interfaces for Microsoft products were available to partners – some were public, some available to certified partners, and others used only internally by Microsoft and its most trusted partners (though European Commission obliged Microsoft to disclose the relevant technical documentation).

Microsoft’s approach involves using seemingly open standards, which could attract as many interested parties as possible, but modifying them slightly to control the group of partners having access to some added-value features of the technology, guaranteeing loyalty by an implicit *technological blackmail*.

Partners involved in standard setting and development of specifications are privileged over other parties because of the early access to technologies and more profound knowledge than provided by official documentation. Microsoft was also embedding in its products components developed by certain partners, offering them opportunities to apply insider knowledge and develop solutions by using methods not available to other players. Wang Laboratories were working with Microsoft on the development of MAPI, an underlying messaging layer for Windows, and benefited from the work by promoting own workflow system to the indignation of other vendors

(Ouellette, 1995). On the other hand, Microsoft's competitor in the portable devices market Palm was not able to strike an interoperability deal with the company – as a result, Palm-based appliances were not able to easily synchronize with Windows computers (Garretson, 2002).

Deterrents

Legal measures

Microsoft's licensing agreements, restricting scope of partners' activities, were frequently debated in courtrooms. The public criticism forced the company to amend its contract templates, dropping some controversial clauses, such as requirements to offer bundled products (e.g. Windows with Internet Explorer, or Internet Explorer with pre-defined Internet content in Active Channels). Microsoft initially barred partners from selling competitive products – hardware makers could not install other operating systems or browsers on PCs (Thibodeau, 1999; Nicolai & Trott, 1997), and ISPs and content providers were prohibited from informing customers about the existence of alternatives to Internet Explorer (Goodin, 1998a, 1998b). Some licensing deals were constructed in ways making the distribution of competitive solutions unprofitable - royalties paid by PC manufacturers for Windows were calculated based on the overall number of computers they manufacture, regardless of which operating system they were shipped with, thus discouraging alternative installations (Caldera, 1996). Partners were also prevented from developing products integrated with Microsoft's competitors - software developers working on applications for Windows 95 received non-disclosure agreements, restricting their involvement in specific competitive initiatives and prohibiting work on own development tools (Johnston et al., 1994).

Such techniques may undermine the intrinsic motivation of partners, exposing the focal company to legal and image problems. Interestingly, relaxing these sometimes outrageous requirements was interpreted by the market as a positive sign, and attracted new supporters for Microsoft technologies.

Partner lock-in

Lock-in conditions occur when a party cannot terminate the relationship without incurring losses or high switching costs (Farrell & Shapiro, 1988). Companies try to take hostages from their partners in form of investments in relation-specific assets, and the creative use of lock-ins became a wide-spread practice in technology management. Semi-openness of technological standards creates an effective partner lock-in – their integrated products cannot easily be ported to other platforms, competencies acquired over time are inextricably linked to the supported technology, while sales relations limit their commercial options.

Even the seemingly open hardware drivers architecture in Windows, designed by Microsoft to support as many compatible devices as possible, offered a way to restrict partner strategies: Kodak accused Microsoft of maintaining control over the

user experiences for digital cameras by streamlining all photo handling processes with bundled software, thus not leaving space for third-party solutions (Wilcox, 2001b). When Microsoft introduced a universal messaging interface MAPI in Windows, developers of competing e-mail software Lotus and Novell abandoned their standardization efforts and supported MAPI only to later discover that Microsoft concealed some elements of the interface, giving Microsoft Exchange a head start on competing systems (Mohan, 1995). ISPs including AOL and Lycos, who licensed Internet Explorer 4.0 code and built custom browser versions for own customers, were later not able to benefit from new features as the architecture of version 5.0 changed (Krigel, 1999).

Probably the most inventive example of technology lock-in was Microsoft's settlement with InterTrust Technologies. InterTrust accused Microsoft of infringing its patent for multimedia rights protection. Microsoft agreed to license the patent, but its validity would be limited to standard implementations of the relevant Microsoft platform. Microsoft's partner – media player maker, online media shop, or media editing software vendor – intending to enrich the technology would have to negotiate separate licensing terms with InterTrust (Roberts, 2004). Because of the substantial costs, everybody preferred to stick to the standard version, thus not endangering Microsoft's dominance in the emerging market. Technology platform locks in partners, restricting their future technological choices and preventing entry in certain markets, while creative strategies allow companies to use other parties to deepen the lock-in, as in the case of litigation threats by an external patent owner.

Extending own platform

While intentional product inferiority and relevant positioning offered partners revenue opportunities, the opposite scenario could be used as an important deterrent. Microsoft was frequently capturing new niches by entering them with own solutions, bundled with established products and cheaper than previously available alternatives.

Pre-emptive product announcements helped eliminate potential competitors, who were abandoning their development plans once Microsoft announced the future availability of certain solutions (even if the announcements were only in early stages and concerned products that never materialized) (Avakian, 1999, p. 47). This mechanism can be interpreted as a counterpart of the inferior product positioning, used as a powerful deterrent to manage expectations of market participants (Farrell & Saloner, 1986).

Eliminating competitors

The previously described payola does not only motivate partners, but also restricts competitors or reduces support for competitive standards. Microsoft tried not to completely eliminate competitors, trying rather to make them dependent on own standards and limit their user bases. The company acquired minority stakes in its competitors Apple, Inprise and Corel, helping them financially in return for strategic subordination. Linux supporters were incensed by Microsoft's acquisition of antivirus business unit of GeCAD Software – its RAV AntiVirus was the best

antivirus solution for Linux platform, no longer available after the acquisition (Evers & Roberts, 2003). Additionally, Microsoft was offering benefits to partners, willing to suspend development of competitive products – for example, HP agreed to give up its e-mail server OpenMail for Windows and support Microsoft Exchange in return for involvement in various joint initiatives and the preferred supplier status (Mohan, 1997). Microsoft was also trying to “convert” key partners of its competitors (as the previously described IBM partners Infolmage and Interliant), or restrict competitors through legal settlements. For example, the company agreed to pay a substantial settlement in patent lawsuits with Sun Microsystems, but Sun was expected to improve interoperability of its products with Microsoft platform (McMillan, 2004). There were cases, when Microsoft intentionally modified own products to disable the usage or deteriorate the performance of competitive applications - Real Networks player failed to run once a competitive Microsoft’s product was installed (Johnston, 1998), and web browser by Opera could not display correctly pages of MSN, as the portal was generating different page views, depending on browser software identified (Hansen & Festa, 2004).

Sales and partnership model

Another deterrent is Microsoft’s sales and partnership model, including elements of the plural governance form (Baker, 1990): parallel work with multiple partners, who compete in specific technological domains and are thus motivated to innovate and differentiate their offerings. This approach limits reliance on individual partners, strengthens Microsoft's bargaining position and preserves the commercial character of relations. Multiple channels and partnership levels support in turn creative distribution of margins and link them to partner investments in marketing, training and technology development.

Research findings – Google’s use of political techniques

Google's attempts to increase the user acceptance of Android, its operating system for mobile devices, resembles the previously presented Microsoft case. Google can be regarded as Microsoft's disciple, as its technological ecosystem resembles the comprehensive network of Microsoft partners. Android is a multi-purpose operating system, initially developed for mobile phones, but with its reach set of features, it is also being used in tablets, electronic devices such as GPS receivers, e-book readers, music and video players, television sets, and even personal computers. While still consider as less powerful and less sophisticated than Microsoft Windows, it has the potential to endanger the platform’s market position, especially for end-user devices. It is important to recognize the similarities between Microsoft's and Google's approaches, as Google's emulation of past Microsoft's activities might yield similar strategic outcomes.

Android continues to rapidly evolve and it seems too early to present its comprehensive historical analysis as the previously described case of Microsoft. The

complex analysis is not feasible yet due to the relevant newness of developments and limited data availability. Nevertheless, Google displays significant similarities to the partnership techniques adopted by Microsoft and described in this article. The company notably refrains from some controversial techniques, which created antitrust problems for Microsoft in the past, thus learning from its predecessor's experiences.

Google uses **financial incentives** on a limited basis, but the overall approach to using money as a means to make friends emulates Microsoft's implicit philosophy. **Minority investments** helped Google secure support for its system platform - an example is games developed by Zynga, initially offered for web-based Facebook platform only, but later released also in Android versions (Carlson, 2010). A variety of direct financial transfers, including joint development projects and subcontracted work helped Google attract and motivate the most promising third-parties.

Indirect financial transfers related to Android are more straightforward than in the Microsoft case. Android operating system is free, and its use for hardware products does not require royalty payments to Google. When compared with competitive mobile operating system platforms, Android is thus subsidized by Google. The company benefits from an advertising-oriented revenue model, and this is a major difference from Microsoft's license-based revenue structure. Making Android available free of charge was an important step in market development, gaining Google numerous supporters, including hardware, software, services and content providers. Among other indirect transfers, Google provided legal advice to Samsung and other Android device manufacturers in patent and copyright infringement cases brought to courts by Apple, Nokia and Microsoft. Moreover, there were speculations that Google covered the costs of professional services of law firm Quinn Emanuel, which was representing Google's partners in infringement lawsuits related to Android-based devices, as part of an indemnity agreement, offered by Google to its partners in order to encourage Android's adoption and limit the legal risks of supporters (Cheng and Sandoval, 2012). Another example of unusual indirect financial contributions was the transfer of two Google's patents to its partner HTC, in order to help the company fight its legal battle against Apple (Cheng, 2011b).

Marketing incentives are implemented on the scale similar to the past determination of Microsoft, helping partners find win-win opportunities within Windows ecosystem. Partners can benefit from **promotion** (campaigns run jointly with Google) and **sales channels** (through Google Play application market and Google-controlled hardware distribution channels). Google makes careful decisions about the **positioning of own products** in order to avoid direct conflicts with partners. For example, Google's own mobile phones branded as Google Nexus, manufactured by Google's Asian partners, have distinctive sets of functionalities, but the company makes sure that handsets sold by its partners are still attractive. A **certification** scheme is implemented to confirm compliance with Google-imposed standards. Apart from a formal acceptance track for new hardware products, inclusion of software applications in Google Play application market also requires validation by Google, confirming safety and conformance to system and design requirements.

Among the possible **technological incentives**, Google clearly engages in **platform management**. Android is an operating system platform, offering opportunities for hardware manufacturers and software developers thanks to the available hardware specifications, as well as the existence of Google Play, an application distribution channel. **Partner-oriented product development** involves among others support for multiple hardware models and availability of drivers for standard peripheral devices. Releases of subsequent Android versions are prepared in ways facilitating their adoption by hardware manufacturers, including upgrade tracks and backwards compatibility. In some contexts, Google also uses the **product inferiority** technique. Even though relevant technologies are available or could easily be developed by Google, some functionality is lacking in specific applications, e.g. as of 2012, there is no offline support in Google Docs for Android, and no dedicated offline task application. Both areas present revenue opportunities for Google partners. Also, the company adopts a staged introduction of new functionalities in order to match the offering of major competing ecosystems, but at the same time prepare partners for the changes and offer them time to look for new differentiators and product concepts. There is a wide variety of **knowledge transfer** scenarios. Google partners can benefit from online learning opportunities, question and answer database, and developer documentation. When introducing Android, Google established close cooperation with key mobile phone manufacturers from Taiwan and South Korea, who in the past used to be important manufacturing partners of Microsoft. **Learning by doing** happens through the multiplicity of handset and tablet models manufactured by partners, enjoying regular technical help from Google and opportunities to experiment with hardware and software. **Stimulation of knowledge generation** occurs through the community of Android developers, at the same time Google engages in repeated ties with specific partners in new product areas, from mobile phones through tablets and other electronic devices, all of them using Android system. **Technical privileging** is effectively enacted even though Android is seemingly open software. In fact, preferred partners get special treatment, with early developer previews, involvement in the preparation of system roadmaps and access to detailed technical documentation.

Deterrents are used by Google with extreme caution, as the company clearly does not want to experience the antitrust problems that Microsoft had in the past. Among **legal measures**, Google assembled a portfolio of patents, supplemented by the acquisition of Motorola Mobility, a major mobile phone manufacturer (Cheng, 2011a). It also adopts restrictive licensing agreements, requiring partners to adjust Android to their devices and submit the software for Google's approval.

Partner lock-ins are achieved thanks to the steep learning curve for Android. Entering the ecosystem requires substantial investment in knowledge acquisition, as development of software and configuration of hardware for Android differs from corresponding activities conducted for other platforms. **Extending own platform** happens as Google gradually adds new functionalities to the system, and thus enters new areas, previously handled by partners. Examples include: release of Chinese input

interface for Android, improvements in standard system web browser, eliminating the need for alternative solutions, and development of Google Drive, substituting various applications, supporting cloud-based document storage. Software partners realize that Google would be capable of implementing most of software functionalities currently available from third-party applications, but for some reasons refrains from this. Similarly, Google releases Android hardware under its own brand, manufactured by selected contractors, but does not display ambitions to dominate the market with Google-branded devices, thus leaving space to other parties. **Sales and partnership model** is based on the previously described plural governance form, with Google's openness to new partnership, maintaining multiple partners in each area, stimulating the competition among them and introducing seemingly objective rankings in Google Play application market. Google does not officially use the technique of **eliminating competitors**, so there are no examples, which could be quoted here. However, once Google is targeted with lawsuits by competitors and undergoes scrutiny of regulatory bodies, relevant information might become available.

Google uses most of partnership techniques described in the article, and the strategy seems an emulation of Microsoft's approach, established in the 1990s. However, the analysis of Google Android ecosystem involves additional elements, which were not present in the case of Microsoft Windows. Android is open source software, which can be freely used by other organizations. The fact facilitated creation of Google competitors, directly using results of Google's work but establishing own ecosystems and undermining Google's revenue opportunities. Examples include modified Android software and related software distribution platforms from: Amazon (Kindle Fire), Barnes&Noble (Nook), Xiaomi (MIUI), as well as non-commercial developer community, maintaining Android release called CyanogenMod. Google also needs to work closely with telecom providers, a very specific group of partners, requiring customizations of phone operating systems, making the Android ecosystem very complex, with multiple not fully compatible releases of the same version of Android, adjusted to requirements of specific telecom operators. The complexity generates additional costs and technical problems for Google, but offers additional motivation for Google's partners and increases their satisfaction.

Google is avidly following Microsoft's partnership model described in the present article. Interestingly, Microsoft departed from its customary approach in 2012, with the release of Windows 8 and start of direct sales of dedicated laptops and tablets, dubbed 'Microsoft Surface'. While Google tries to assemble as big an 'army' of Android partners and supporters as possible, Microsoft plans to loosen the long-term ties and become more self-sufficient. The move could be risky, as Windows strength used to lie in the broad support by third-parties. Microsoft seems to imitate the strategy of Apple - leader of another operating system platform, a company controlling key software, hardware and end user experience, thus dominating technology partners and not being vitally interested in their benefits or synergies within the ecosystem, but rather remaining focused on maximizing own revenues, often at the cost of partners. It is possible that Google Android ecosystem would replace the previous partnership structure, maintained by Microsoft for its Windows platform.

Conclusions

The research outlined the multiplicity of available partnership techniques, but companies trying to learn from Microsoft’s and Google’s experiences should consider the effectiveness of these techniques in specific situations. Table 1 presents their varying relevance for the following scenarios: decreasing transaction costs (thus attracting new players to the ecosystem), stimulating relation-specific investments (in order to induce commitment), increasing innovativeness (focus on long-term health of the technological platform) and restricting new product development decisions (blocking potential rivals).

Table 1. Partner management techniques and their impact on strategies of partners

	Partnership technique	Decreasing partner’s transaction cost?	Stimulating partner’s relation-specific investments?	Stimulating partner’s innovativeness?	Restricting partner’s new product development decisions?
Financial incentives	Minority investment		√		√
	Direct transfers	√	√	√	√
	Third-party investment		√		√
	Pricing technology	√	√	√	√
	Reference designs	√			√
Marketing incentives	Promotion	√	√		√
	Sales	√			√
	Positioning own products	√		√	
	Certification		√		√
Technical incentives	Platform management	√			√
	Partner-oriented development	√			
	Product inferiority	√		√	
	Knowledge transfer	√	√	√	√
	Learning by doing	√	√	√	√
	Stimulating knowledge generation	√		√	
	Technical privileging	√			
Deterrants	Legal measures		√		√
	Partner lock-in		√		√
	Extending platform			√	
	Eliminating competitors		√		√
	Sales and partnership model		√	√	

Partner management techniques help establish coalitions to support new technological platforms. Availability of complementary products is critical, so “buying” partners and treating them with respect is advisable. Partners are also needed to add credibility to the core technology and to shorten time-to-market (Roberts & Liu, 2001, p. 27) - Microsoft and Google could develop own solutions in all concerned areas, but

this would not give it time-based advantages over competitors. *Payola* is indispensable for those partners, who regard the new technology as a threat, since its diffusion could substitute their products and destroy competences. When Microsoft was co-opting partners to support Windows for enterprise computing, it had to deal with established companies, deriving large shares of revenues from the rival Unix system – and only political actions helped guarantee the needed support. Similarly, Google’s attempts to gain support for Android were targeted at companies already involved in competitive ecosystems. Costly incentives for first partners motivated other companies to jump the Windows and Android bandwagons. Partner relationships, established to promote new platforms, have self-reinforcing character: large installed bases attract new partners (Hill, 1997, p. 9).

The historical analysis of Microsoft’s experiences suggests that the stage of technology lifecycle is an important factor when choosing partner management techniques. It does not seem feasible to offer unequivocal guidelines for different lifecycle stages (Roberts & Liu, 2001, 2003) - instead, managers should understand, which particular incentives and deterrents are suitable for specific stages of the lifecycle. Table 2 singles out the initial era of ferment, when companies struggle to build the largest installed base, and the period of technology platform dominance (Anderson & Tushman, 1990). Some partner-oriented activities are effective in expanding the installed base, while not being critical for further technology development – for example, cash inducement is instrumental in co-opting complementors, but not necessary for established technological platforms.

Table 2. Changing effectiveness of partner management techniques in technology lifecycle

	Partnership technique	Expanding installed base	Managing established platform
Financial incentives	Minority investment	√	
	Direct transfers	√	√
	Third-party investment	√	
	Pricing technology	√	√
	Reference design	√	√
Marketing incentives	Promotion	√	√
	Sales	√	√
	Positioning own products		√
	Certification	√	√
Technical incentives	Platform management	√	√
	Partner-oriented development	√	
	Product inferiority		√
	Knowledge transfer	√	√
	Learning by doing	√	√
	Stimulating knowledge generation	√	√
	Technical privileging		√

	Partnership technique	Expanding installed base	Managing established platform
Deterrents	Legal measures	√	√
	Partner lock-in		√
	Extending platform	√	√
	Eliminating competitors	√	√
	Sales and partnership model	√	√

Both analyzed cases prove that the competence-destroying character of innovations, which usually is a barrier to adoption and support from other companies, can be *de-emphasized* thanks to the use of adequate techniques. Moreover, both Microsoft and Google used recurring ties to accelerate the introduction and adoption of innovations – with partner-oriented technology development, they started *competence planning* for their own partners, designing products to *re-use* their existing skills. The repetitive ties with dedicated partners turn out to be cheaper than building new partner coalitions and co-opting necessary players for every new technology.

Literature recommends structuring technology deals in ways maximizing revenue streams throughout the entire lifecycle (Shapiro & Varian, 1999, p. 143-148), initially encouraging adoption by means of low pricing, while in further stages benefiting from lock-in effects, and finally, carefully planning substitutive offerings. It seems too premature to address this issue based on Google's ecosystem due to the newness of developments. However, Microsoft adopted this approach to partners, not thinking about alliances as 'one-off' means to boost product diffusion, but cultivating them to achieve synergies across many businesses, and preparing for the introduction of new product generations. Technologically locked-in partners were not victims, but important social capital, useful in other projects.

References

- Anderson, P., Tushman, M.L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly*, 35, 604-633.
- Astley, W.G., Zajac, E.J. (1991). Intraorganizational Power and Organizational Design: Reconciling Rational and Coalitional Models of Organization. *Organization Science*, 2 (4), 399-411.
- Avakian, P.N. (1999). Political Realities in Strategy. *Strategy & Leadership*, 27 (6), 42-48.
- Baker, W.E. (1990). Market Networks and Corporate Behavior. *American Journal of Sociology*, 96 (3), 589-625.
- Becker, D. (2002). Microsoft Makes Rare Buyout Official, CNET News.com, September 24. Retrieved from <http://news.cnet.com/2100-1040-959248.html>, access date: 5 November 2012.
- Borland, J. (2004). 'Plays for sure' Means Microsoft's Inside, CNET News.com, August 25. Retrieved from http://news.cnet.com/Plays-for-sure-means-Microsofts-inside/2100-1025_3-5324402.html, access date: 5 November 2012.

- Busse, T. (1998). Microsoft, Partners Cook up New Multimedia Format, *Computerworld*, April 6.
- Cafasso, R. (1994). SAP, Microsoft Extend Relationship, *Computerworld*, August 29.
- Caldera (1996). Complaint in the United States District Court, District of Utah, Central Division. Caldera, Inc, Plaintiff, vs. Microsoft Corporation, Defendant. Retrieved from www.digitalresearch.biz/DR/Info/COMPLAIN.HTM, access date: 5 November 2012.
- Carlson, N. (2010). Google Invested in Zynga to Weaken Facebook, *Business Insider*, July 12. Retrieved from <http://www.businessinsider.com/google-invested-in-zynga-to-weaken-facebook-2010-7>, access date: 5 November 2012.
- Cheng, R. (2011a). Google to Buy Motorola Mobility for \$12.5B, *CNET News.com*, August 15. Retrieved from [http://news.cnet.com/8301-1035_3-20092362-94/google-to-buy-motorola-mobility-for-\\$12.5b](http://news.cnet.com/8301-1035_3-20092362-94/google-to-buy-motorola-mobility-for-$12.5b), access date: 5 November 2012.
- Cheng, R. (2011b). HTC Sues Apple Using Google Patents, Report Says, *CNET News.com*, September 7. Retrieved from http://news.cnet.com/8301-1035_3-20102903-94/htc-sues-apple-using-google-patents-report-says, access date: 5 November 2012.
- Cheng, R., Sandoval, G. (2012). How Google's Stealth Support is Buoying Samsung in Apple Fight, *CNET News.com*, August 10. Retrieved from http://news.cnet.com/8301-13579_3-57490398-37/how-googles-stealth-support-is-buoying-samsung-in-apple-fight, access date: 5 November 2012.
- Christensen, C. (2000). The Innovator's Dilemma. *New York: HarperBusiness*.
- Coase, R.H. (1979). Payola in Radio and Television Broadcasting. *Journal of Law and Economics*, 22 (2), 269-328.
- Cole-Gomolski, B. (1999). EDS, Microsoft Form Alliance. *Computerworld*, July 21.
- Cowley, S. (2002). Microsoft to Use Crystal Enterprise in CRM. *Computerworld*, June 19.
- Cusumano, M.A., Gawer, A. (2002). The Elements of Platform Leadership. *MIT Sloan Review*, 43 (3), 51-58.
- Das, T.K., Teng, B.S. (2002). The Dynamics of Alliance Conditions in the Alliance Development Process. *Journal of Management Studies*, 39 (5), 725-746.
- Dash, J. (2000). Microsoft, Andersen Form Win 2K E-commerce Venture. *Computerworld*, March 13.
- Deckmyn, D. (1999). Microsoft Signs up Infolmage for Digital Dashboard. *Computerworld*, October 14.
- Deckmyn, D. (2000). Microsoft, Interliant Tune Exchange for ASP Market. *Computerworld*, March 15.
- DiDio, L. (1997). Cisco, Microsoft to Lift Active Directory. *Computerworld*, May 12.
- Dyer, J.H., Kale, P., Singh, H. (2004). When to Ally & When to Acquire. *Harvard Business Review*, 81 (7-8), 109-115.
- Elg, U., Johansson, U. (1997). Decision Making in Inter-firm Networks as a Political Process. *Organization Studies*, 18 (3), 361-384.
- Evers, J., McMillan, R. (2003). Real Sues Microsoft, Alleges Monopoly Abuse. *Computerworld*, December 19.

- Evers, J., Roberts, P. (2003). Microsoft to Kill Popular Linux Antivirus Product. *Computerworld*, June 12.
- Farrell, J., Saloner, G. (1986). Installed Base and Compatibility: Innovation, Product Preannouncement, and Predation. *The American Economic Review*, 76 (5), 940-955.
- Farrell, J., Shapiro, C. (1988). Dynamic Competition with Switching Costs. *RAND Journal of Economics*, 19 (1), 123-137.
- Garretson, C. (2002). AOL, Palm Execs See Threat from Microsoft. *Computerworld*, April 4.
- Goldberg, M., Bozman, J.S. (1995). Microsoft/DEC Deal to Buoy NT, Alpha. *Computerworld*, August 7.
- Golde, E. (1997). Microsoft Taps CA's InocuLAN for NT Virus Protection. *Computerworld*, August 13.
- Goodin, D. (1998a). MS Changes European ISP Deals, CNET News.com, January 20. Retrieved from http://news.cnet.com/MS-changes-European-ISP-deals/2100-1001_3-207285.html, access date: 5 November 2012.
- Goodin, D. (1998b). Microsoft Changes Content Deals, CNET News.com, April 9. Retrieved from http://news.cnet.com/Microsoft-changes-content-deals/2100-1001_3-210054.html, access date: 5 November 2012.
- Gulati, R. (1995). Social Structure and Alliance Formation Pattern: A Longitudinal Analysis. *Administrative Science Quarterly*, 40, 619-652.
- Gulati, R., Higgins, M.C. (2003). Which Ties Matter When? The Contingent Effects of Interorganizational Partnerships on IPO Success. *Strategic Management Journal*, 24, 127-144.
- Hansen, E., Festa, P. (2004). Microsoft Behind \$12 million Payment to Opera, CNET News.com, May 24. Retrieved from http://news.cnet.com/2100-1032_3-5218163.html, access date: 5 November 2012.
- Heskett, B. (1998). CA's NT Claims under Fire, CNET News.com, April 29. Retrieved from http://news.cnet.com/CAs-NT-claims-under-fire/2100-1001_3-210721.html, access date: 5 November 2012.
- Hill, Ch.W.L. (1997). Establishing a Standard: Competitive Strategy and Technological Standards in Winner-take-all Industries. *Academy of Management Executive*, 11 (2), 7-25.
- Iansiti, M., Levien, R. (2004). Strategy as Ecology. *Harvard Business Review*, 82 (3), 69-78.
- IDC 2007. The Economic Impact of IT, Software, and the Microsoft Ecosystem on the Global Economy, IDC White Paper, October 2007. Retrieved from http://download.microsoft.com/download/9/a/2/9a22a977-f5ce-40b0-b9cf-79f49e7e5ff5/IDC_Global_White_Paper.doc, access date: 5 November 2012.
- Johnston, M. (1998). RealNetworks Senate Demo Slams Microsoft. *Computerworld*, July 23.
- Johnston, S.J. (1994). Microsoft Settles for Piece of the Stac. *Computerworld*, June 27.
- Johnston, S.J. (1995). Antivirus Utilities Hold Strong. *Computerworld*, May 29.
- Johnston, S.J., Scannell, E., Ballou, M.C. (1994). Chicago Beta Contract Angers Top Developers. *Computerworld*, April 25.
- Kale, P., Puranam, P. (2004). Choosing Equity Stakes in Technology-Sourcing Relationships: An Integrative Framework. *California Management Review*, 46 (3), 77-99.

- Klincewicz, K. (2005). Strategic alliances in the high-tech industry, Berlin: Logos Verlag. Retrieved from http://otworzksiazke.pl/images/ksiazki/strategic_alliances_in_the_high-tech_industry/strategic_alliances_in_the_high-tech_industry.pdf, access date: 5 November 2012.
- Krigel, B.L. (1999). Why Did Microsoft Keep Browser Feature from Partners? CNET News.com, July 30. Retrieved from http://news.cnet.com/Why-did-Microsoft-keep-browser-feature-from-partners/2100-1023_3_229276.html, access date: 5 November 2012.
- Luening, E. (1998). Short Take: Symantec, MS Team on Faxing, CNET News.com, January 20. Retrieved from http://news.cnet.com/Short-Take-Symantec,-MS-team-on-faxing/2110-1001_3-207259.html, access date: 5 November 2012.
- Luening, E. (2001). Microsoft Enlists VC Firm in .Net Push, CNET News.com, August 14. Retrieved from <http://news.cnet.com/2100-1001-271568.html>, access date: 5 November 2012.
- MacDonald, Ch. (1997). MS Woos Banks with Fee Cuts, CNET News.com, March 27. Retrieved from http://news.cnet.com/MS-woos-banks-with-fee-cuts/2100-1017_3-278327.html, access date: 5 November 2012.
- McLoughlin, I., Koch, Ch., Dickson, K. (2001). What's This "Tosh"?: Innovation Networks and New Product Development as a Political Process. *International Journal of Innovation Management*, 5 (3), 275-298.
- McMillan, R. (2004). Sun-Microsoft Deal Raises OpenOffice Questions. *Computerworld*, September 16.
- McMillan, R., Evers, J. (2004). Microsoft behind \$50M SCO Investment. *Computerworld*, March 11.
- Mohan, S. (1995). Microsoft Accused of MAPI Secrets. *Computerworld*, June 5.
- Mohan, S. (1997). HP/MS Deal a Boon to Messaging, CNET News.com, March 26. Retrieved from http://news.cnet.com/HPMS-deal-a-boon-to-messaging/2100-1001_3-278318.html, access date: 5 November 2012.
- Nash, K.S. (1998). Microsoft to Sell its 10% Stake in RealNetworks. *Computerworld*, November 23.
- Nicolai, J., Trott, B. (1997). DOJ Documents: Microsoft Leaned on Compaq. *Computerworld*, October 23.
- Ouellette, T. (1995). Microsoft Pulls Oars out of Workflow Waters. *Computerworld*, September 4.
- Ouellette, T., Weinberg, N. (1995). Win 95 Polishes Wang Image. *Computerworld*, April 17.
- Padgett, J.F., Ansell, Ch.K. (1993). Robust Action and the Rise of the Medici, 1400-1434. *American Journal of Sociology*, 98 (6), 1259-1319.
- Pelline, J. (1996). Microsoft Ropes in Another ISP, CNET News.com, July 30. Retrieved from http://news.cnet.com/Microsoft-ropes-in-another-ISP/2100-1023_3-219402.html, access date: 5 November 2012.
- Ricciuti, M. (1996). Microsoft Juices up Shockwave, CNET News.com, June 3. Retrieved from http://news.cnet.com/Microsoft-juices-up-Shockwave/2100-1023_3-213525.html, access date: 5 November 2012.

- Ring, P.S., Van de Ven, A.H. (1994). Developmental Processes of Cooperative Interorganizational Relationships. *Academy of Management Review*, 19 (1), 90-118.
- Roberts, E.B., Liu, W.K. (2001). Ally or Acquire? How Technology Leaders Decide. MIT *Sloan Management Review*, 43 (1), 26-34.
- Roberts, E.B., Liu, W.K. (2003). Ally or Acquire? Case Studies of Compaq and Cisco as Additional Tests of the External Technology Life Cycle Model. MIT Sloan School of Management Working Paper, 4421-03.
- Roberts, P. (2004). Microsoft, InterTrust Settle Patent Case for \$440M. *Computerworld*, April 12.
- Rokkan, A.I., Heide, J.B., Wathne, K.H. (2003). Specific Investments in Marketing Relationships: Expropriation and Bonding Effects. *Journal of Marketing Research*, 40, 210-224.
- Shankland, S. (1999). Microsoft Funds Perl Open-source Effort, CNET News.com, June 2. Retrieved from http://news.cnet.com/Microsoft-funds-Perl-open-source-effort/2100-1001_3-226633.html, access date: 5 November 2012.
- Shapiro, C., Varian, H.R. (1999). Information Rules. A Strategic Guide to the Network Economy. Boston: *Harvard Business School Press*.
- Sliwa, C. (1999). Upstart Java Clone Backed By Microsoft. *Computerworld*, June 21.
- Sliwa, C. (2000). New Microsoft Technology Helps Suppliers "Accelerate" Business on the Web. *Computerworld*, November 8.
- Sykes, R. (1998). In Another Courtroom, Microsoft Under Fire. *Computerworld*, October 15.
- Thibodeau, P. (1999). MS/DOJ: Did Compaq Change Handheld Partners to Please Microsoft? *Computerworld*, February 18.
- Uzzi, B. (1999). Embeddedness in the Making of Financial Capital: How Social Relations and Networks Benefit Firms Seeking Financing. *American Sociological Review*, 64: 481-505.
- Vijayan, J. (2001). Microsoft Revises Software Licensing Program for ASPs. *Computerworld*, December 3.
- Wasserman, E. (1999). IBM Exec Details Microsoft Tactics. *Computerworld*, June 7.
- Wathne, K.H., Heide, J.B. (2000). Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions. *Journal of Marketing*, 64, 36-51.
- Weinstein, N. (2001). Thirty-eight Xbox Games Available, CNET News.com, December 28. Retrieved from <http://news.cnet.com/2110-1040-277469.html>, access date: 5 November 2012.
- Wilcox, J. (2001a). Microsoft to Charge for MP3 Ripping, CNET News.com, July 16. Retrieved from <http://news.cnet.com/2100-1001-269967.html>, access date: 5 November 2012.
- Wilcox, J. (2001b). Microsoft, Kodak Settle XP Dispute, CNET News.com, August 12. Retrieved from http://news.cnet.com/Microsoft,-Kodak-settle-XP-dispute/2100-1003_3-271490.html, access date: 5 November 2012.
- Wong, W. (1997). MCI Custom Builds 'net Pipeline for Microsoft. *Computerworld*, October 21.

Abstract (in Polish)

Artykuł prezentuje alianse technologiczne jako działania o charakterze politycznym, pomagające budować koalicje, kooptować sojuszników i eliminować rywali. W oparciu o przykłady ekosystemów partnerskich firm Microsoft i Google, omówione zostają specyficzne techniki stosowane w odniesieniu do partnerów i ich przydatność dla firm technologicznych. Artykuł oferuje bogaty przegląd faktograficzny, dotyczący rozwoju platform Microsoft Windows i Google Android, w połączeniu z działaniami, podejmowanymi przez obie firmy w celu zapewnienia wsparcia ze strony firm partnerskich. Skuteczność zachęt o charakterze finansowym, marketingowym i technologicznym, jak również działań odstrasżających, jest uzależniona od oczekiwanych rezultatów (taki jak: redukcja kosztów transakcyjnych, uzależnianie partnera, stymulowanie innowacyjności lub ograniczanie rozwoju konkurencyjnych produktów), jak również etapu cyklu życia technologii. Artykuł pomaga kształtować strategie współpracy z partnerami i optymalizować inwestycje, niezbędne dla motywowania i kontrolowania partnerów.

Słowa kluczowe: sojusze technologiczne, zarządzanie partnerami, perspektywa polityczna, Microsoft, Google

Global Business Networks and Cooperation within Supply Chain as a Strategy for High-Tech Companies' Growth

*Milena Ratajczak-Mrozek**

Abstract

The specificity of the operation profile of high-tech companies, including the necessity of operating at the international scale may account for the fact that these companies may find in network relationships, business networks and cooperation an essential determinant for growth and competitiveness. Foreign entities should be especially interesting business partners for high-tech companies, as they are often seen as representing more advanced knowledge, resources and experience. The aim of the article is to point out to global business networks (i.e. including both local and foreign entities), and especially to cooperation within supply chain, as an important basis for a growth strategy of a high-tech company.

The article adopts assumptions of the network approach as a concept of companies cooperation. An analysis of the author's own as well as secondary empirical research, with the focus on high-tech companies located in Poland is presented. In particular, the data from own research of 62 high-tech companies in Poland conducted in the first half of 2011 is analysed. It shows that the high-tech companies placing great importance on cooperation within supply chain demonstrate a higher growth and level of competitiveness than the companies which do not ascribe such importance (bearing in mind that supply chain forms an important part of a business network).

Keywords: high-tech companies, high-technology companies, industrial network, business network, network approach, cooperation, supply chain management, competitiveness, company performance, growth strategy

Introduction

Due to globalisation of competition and fast rate of changes occurring in micro- and macro environment, high-tech companies may not reach satisfactory benefits if they shut out cooperation and limit their strategies to internal development of technology. Moreover, a question arises whether in the face of growing interrelations between entities, internationalisation of operation and the rate of technology development, such shutting out of high-tech companies is possible at all?

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More and more often the necessity of cooperation and developing partnerships (relationships) with external entities, which can significantly influence a company's success, is emphasized in research (see Wilson and Mummalaneni, 1986, p. 44-58; Fonfara, 2009, p. 3). In network relationships, global business networks and cooperation companies may find an essential determinant of growth and competitiveness. Of all the groups of entities with which companies may cooperate, the biggest attention is paid to those constituting links in supply chain (see Gadde and Snehota 2000, p. 305-316; Hollensen, 2003, p. 197-254; Golcic 2007, p. 719-739; Barry, Dion and Johnson 2008, p. 114-135). And precisely this strategy, i.e. concentration on global business networks, and especially cooperation within supply chain, may bring satisfying results to high-tech companies and ensure their growth and competitiveness.

The aim of the article is to point out to global business networks, and especially to cooperation within supply chain, as an important basis for a growth strategy of a high-tech company. In order to attain this goal, the article presents an analysis of the author's own as well as secondary empirical research, with the focus on high-tech companies located in Poland.

Global business networks and supply chains – theoretical background

The network approach is a concept of cooperation of companies which was conceived in late 1970s. This concept stresses the significance of all the contacts (network relationships) a company has with the entities in its surrounding environment. Breakthrough outlooks in this field were presented by the scientists connected with Industrial Marketing and Purchasing Group (IMP Group) (<http://www.impgroup.org/>). A network relationship is a general phenomenon that persists over a longer time and is developed through interactions between entities (Easton, 1992, p. 4). All the company's relationships constitute an extended network – a business network (an industrial network).

The literature of the subject points to two theoretical trends relating to the emergence of business networks – the network approach consistent with the main IMP Group research stream and the concept of strategic business network.

According to the network approach consistent with the main IMP Group research stream, a business network is constituted by a collection of long-term formal and informal relationships (direct and indirect) which exist between two or more entities (Håkansson and Snehota, 1989). Within the considered framework, a system of relationships is often characterised as being decentralized and informal. The business network is an effect of historical cooperation, whilst through cooperating and a series of interactions, entities adjust to each other, create cooperation norms and build trust. Usually none of the entities plays a dominant role (Turnbull, Ford and Cunningham, 1996, p. 44-62; Ford, Håkansson and Johanson, 1986, p. 26-41).

Companies, increasingly frequently, consciously, and in a strategic manner, create business networks concentrated around them. These types of relationships illustrate the strategic approach to the development of network relationships. The strategic

approach (D'Cruz and Rugman, 1993; Jarillo, 1995) stresses active and conscious development of a network of relationships and the presence of one main entity (flagship firm) intentionally building a strategic network. The main characteristic of relationships between the partners of a network is the asymmetric and strategic control exercised by one flagship company over the remaining (independent or "slightly" dependent) companies. The focal company specialises in areas of the value chain in which it is most competent. The remaining necessary resources are sourced from other entities via subcontracting or outsourcing. The flagship firm only has strategic control over those aspects of its partners' business systems which are dedicated to the network. Over time, the participants of the strategic business network adapt their behaviour to that of other partners, thereby expanding cooperation to include informal links, too (Jarillo, 1988, p. 31-41).

It must be underlined that both of the approaches regarding the creation of business networks are not opposed to each other. These approaches should be considered as complementary (Ratajczak-Mrozek, 2010, p. 14-15). Moreover, the literature pertaining to industrial marketing indicates a wide range of companies' cooperation concepts connected with the idea of business network. It is shown that cooperation can be developed in clusters (DeBresson, 1996, p. 161), joint ventures, strategic alliances (Ancarani and Shankar, 2003, p. 2-3), logistics networks (Wimmer, Mandják and Esse, 2010, p. 2-3), virtual organizations (Anderson, Håkansson and Johanson, 1994, p. 1) etc. A detailed analysis, however, reveals that each of the identified structures constitutes a specific type of a business network, enriched by additional assumptions or, in some cases, considered from the perspective of a dyadic relationship (Ratajczak-Mrozek, 2010, p. 16-21; Anderson et al., 1994, p. 1-2).

Network relationships may be established and maintained at the local level, the country level or broader – at the international level encompassing foreign entities. According to the network model of internationalisation, the process of company's internationalisation is defined as the establishment, maintenance and development of formal and informal relationships with network participants on foreign markets (Johanson and Mattsson, 1988, p. 287). This model stresses the importance of developing long-term interactions with entities from the foreign environment (Blankenburg, 1995). In case the relations are extended beyond the local, country framework, the networks become global networks, i.e. networks including also foreign entities.

The idea of a strategic network can be linked to the concept of logistics networks and supply chain. The supply chain can be defined as a network of connected and interdependent organisations which act on the basis of joint cooperation, jointly control, manage and improve the resource and goods flows from suppliers to the final consumer. Therefore, supply chain constitutes a fragment of the overall subject of business networks. Encompassing foreign entities, supply chain is a selected, limited in terms of its objects, fragment of a general global business network.

Research carried out to date devotes most of its attention precisely to the vertical network relationships between customers and suppliers within supply chain (see: Håkansson, Johanson and Wootz, 1976, p. 319-332; Ford, 1984, p. 101-113; Gadde and Snehota, 2000, p. 305-316; Hollensen, 2003, p. 197-254; Golicic, 2007, p. 719-739; Barry, Dion and Johnson, 2008, p. 114-135). This is a result of more intense cooperation between companies and entities forming their supply chain as opposed to other entities in their environment (such as competitors, influential entities). Additionally, this might be linked to more clearly visible positive effects which can be tied to network relationships within supply chain (also at the international scale). That is the reason why particular attention should be in fact given to the analysis of relationships and network relationships between entities within supply chain.

Conceptual framework

The term “high technologies” encompasses areas and products which are characterised by high R&D intensity and additionally a high level of innovativeness, short life cycles of products and processes, fast diffusion of innovations, a growing demand for highly qualified staff (especially in the field of technical and natural sciences), great capital outlays, high investment risk (and fast “ageing” of investment), close scientific and technical cooperation (within individual countries and on the international arena, between companies and research institutions), and growing competition in international trade (Niedbalska, 1999, p. 98).

The clear specificity of the operation profile of high-tech companies, resulting from the quoted definition, is the reason why in the case of these entities, due to short life cycles and usually long development period of products, the ability to gain advanced knowledge, broaden the technological base, and reduce costs and risk becomes important, and this indeed may be secured by cooperation and business networks (see European Commission, 2003, p. 9).

On the other hand, internationalisation of high-tech companies operations may be perceived to be not a matter of choice, but a necessity. Domestic market creates too limited demand for products offered by these companies which have to be quickly commercialised (Madsen and Servais, 1997, p. 561-583; Spence, 2003, p. 227). The more so is international orientation necessary for small and medium-sized high-tech companies, i.e. for their growth and long-term survival (Karagozoglu and Lindell, 1998). It seems that the necessity of operating at the international scale together with the rest of the specificity of operation of high-tech companies is the reason why foreign entities should be especially interesting business partners for these companies. Due to different location, business environment and experience, these entities possess different knowledge (often perceived to be more advanced) and different resources. For this reason cooperation with these entities should be measurably beneficial to high-tech companies.

Taking into consideration the specificity of high-tech companies, a conceptual research framework was developed based upon the above presented interrelations

between global business networks and supply chain. It embraces three elements: global business networks and high-tech company's relationships with different local and foreign entities; cooperation and relationships within supply chain; and, finally, the company's growth and competitiveness as important elements of a growth strategy of high-tech company (see Figure 1).



Figure 1. Conceptual Framework

A high-tech company operates within a global business network maintaining various relationships with different types of local and foreign entities (suppliers, customers, subcontractors, influential entities, competitors). Supply chain and vertical relationships play a significant role as part of a business network. The analysis below places a special emphasis on these relationships and high-tech company's cooperation within supply chain.

It is assumed that the above-mentioned interrelations and including them in a strategy is important for the high-tech company's growth and competitiveness. Business networks and cooperation are not the sole factors influencing the company's growth; however, the analysis aims to indicate a certain tendency and to point out the importance of global business networks.

The further parts of the article firstly present a theoretical analysis and previous research based on the author's own and secondary data concerning global business networks and cooperation within supply chain as an important basis for the growth strategy of high-tech companies. Secondly, taking for the basis the conclusions from previous research, an analysis of the most recent author's own research concerning cooperation of high-tech companies within supply chain and the role of this cooperation in the growth and competitiveness of the discussed companies is presented.

Global business networks and cooperation within supply chain as a source of growth and competitiveness of high-tech companies – the analysis of previous research

Benefits from global business networks

Business networks and network relationships require a new look at the issue of the company's growth and competitiveness which has to take into account the effects of relationships and many interrelations between business entities. The existence of

global business networks may be a source of many potential benefits for a high-tech company, which in turn may contribute to its growth and competitiveness. Amongst the important benefits from building relationships within global business networks and cooperation, there would be the following (Glabiszewski and Sudolska, 2009, p. 17; Gorynia and Jankowska, 2008, p. 136; Plawgo, 2005, p. 21; Ratajczak-Mrozek, 2012, p. 54-72; Sudolska, 2008, p. 109):

- access to resources and capabilities,
- access to knowledge,
- increasing the innovativeness of the company and its products,
- cost reduction,
- reducing operational risk,
- increasing bargaining power against other entities,
- the benefits of specialisation,
- economies of scale and increased market range (at the local and international scale).

Amongst the above-mentioned benefits the issues of resources and knowledge deserve special emphasis as regards high-tech companies. Network relationships enable acquisition of resources which are at partners' disposal and also give ability to obtain resources unavailable thus far to any of the parties. It is straightforwardly stressed that resources which are difficult to duplicate cannot be obtained through ordinary market transactions, but through an exchange within the network relationship framework (Ring, 1996, p.10). Thanks to foreign network relationships, companies are open to both domestic and foreign external resources. The research confirms that amongst high-tech companies in Poland mutual supplementation of resources (and especially technology) is a popular form of interrelations between companies of diverse competence and capabilities (Włosiński, Szerenos, 2006, p. 85). On the other hand, the research from New Zealand suggests that high technology companies, which increase their resource base through external relation networks, attain a higher sales growth (Wilson and Appiah-Kubi, 2002, p. 54-59).

In the case of high-tech companies, sometimes straightforwardly called knowledge intensive firms, knowledge is especially important (Johnson, 2004, p. 139-154). Knowledge is of particular importance for the competitiveness of companies, since their unique integration is the factor that can differentiate a company. The company's learning processes are amplified in particular by network relationships (Johansson, 2001, p. 23; Håkansson, Havila and Pedersen, 1999 pp. 443, 450). The research confirms that in the case of companies within the biotechnology sector in Poland, the imperative factor inducing companies to cooperate is the craving for knowledge. Another important reason for establishing cooperation is conduct of research on new products and technologies (Żelazko, 2009, p. 98). Empirical data also confirms that large innovative projects are developed, managed and commercialised within business networks rather than by single enterprises (European Commission, 2003, p. 38).

Owing to the exchange of resources and knowledge within global business network, it is possible to increase the innovativeness of the company and its products. In order to maintain the competitive advantage on international markets, high-tech companies must have technological advantage (Li, Lam and Qian, 2000, p. 457). At the same time, the growing correlation between previously independent technologies makes it more and more difficult for the companies to develop them on their own (Contractor, Kim and Beldona, 2002, p. 496). Cooperation constitutes a significant factor in the process of discovery, application and diffusion of innovation (OECD, 2000, p. 38). Vertical relationships (with suppliers and customers) (Håkansson, Lundgren, 1995, p. 307-309) and horizontal relationships (with research institutes, competitors or complementary companies) (Håkansson and Lundgren 1995, p. 308; Thomas and Ford, 1995, p. 271), as well as social networks (Davies and Koza, 2001, p. 95-102), influence the company's innovation. In turn, innovation is crucial for the company's growth and competitiveness (Drucker, 1985; Kay, 1993), even more under global competition conditions.

Global business networks and network relationships may additionally have a positive effect, among other things, on the course of production and logistic processes inside the company, which together contribute to an increase in effectiveness, increasing bargaining power against other entities, as well as to cost minimisation and risk reduction. Thanks to local and foreign relationships, a company may specialise in business activities in these areas of the value chain which allow it to obtain competitiveness to the greatest degree (Cravens, Piercy, Shipp, 1996, p. 204; Christopher, Payne and Ballantyne, 2002, p. 121).

The benefits of global business networks related to the expansion of high-tech companies should also be noted. This refers both to gaining new local customers and to expansion on foreign markets through relationships with foreign entities, i.e. company's internationalisation. Research (Kennedy and Keeney, 2006; Schwens and Kabst, 2006) confirms that in the case of high-tech companies cooperation is an important mechanism of entering foreign market, which enables them to accelerate the sales cycles and reduce the risk. Moreover, it should be noticed that the processes of competitive strategy internationalisation as well as the new sources of its competitiveness occur alongside the process of extending company's operation to new markets. Thus internationalisation generates potential for the company's growth (Sapienza, Autio, George and Zahra, 2006, p. 919-920). As a result of extending operation to new markets, a growth in sales volume may occur. This in turn contributes to achieving economies of scale through increasing the scale of production and makes it possible to avoid the negative effects of shortening the high-tech product life cycle.

In order to benefit from global business networks for a long-term and in a possibly sustainable manner, a strategic approach to building these networks is necessary. In one word, global business networks and cooperation must become a permanent strategy basis.

The research conducted in 2007 on a sample of 74 high-tech companies (Ratajczak-Mrozek, 2010) proved that 76% of the surveyed high-tech companies, which actively

built network relationships with foreign entities, achieved financial and non-financial results which were better than these of their closest competitors. For the sake of comparison, amongst the companies which were passive in terms of building network relationships and business networks, only as few as 58% of companies declared achievement of better results. Furthermore, the thesis that the achievement of competitive advantage by high-tech companies is connected with active and conscious building of network relationships was also positively verified in terms of statistical regression.

In that research the relative differences in financial and non-financial performance were studied based on a consolidated formula including profit, sale volume, return on investment (ROI), and market share. Using the Likert scale the respondents were to provide their own self-assessment of these measures in relation to the closest competitors. At the same time, it should be remembered that active building of network relationships is not the only factor having a bearing on the results achieved by the surveyed high-tech companies, nevertheless, the observed trend enabled confirmation of a positive influence of active and conscious building of network relationships on the results achieved by these companies.

Positive effects of cooperation within supply chain

Of all the groups of entities with which companies (both high-tech and representing traditional sectors) may cooperate, attention is mostly paid to these constituting links in supply chain (see Gadde and Snehota, 2000, p. 305-316; Hollensen, 2003, p. 197-254; Golicic, 2007, p. 719-739; Barry, Dion and Johnson, 2008, p. 114-135). Moreover, the research confirms that vertical links (between customers and suppliers) are more often developed among high-tech companies located in Poland than horizontal links (between competitors or institutions of research or education), which concerns both cooperation with national (Włosiński and Szerenos, 2006) and foreign entities (Ratajczak-Mrozek, 2010; Włosiński, Szerenos, 2006). Generally, companies continue to cooperate with each other within the framework of supply chain more and more often.

The great importance attached to cooperation with entities within supply chain is connected with positive results, which are faster and more directly noticed and which may be connected with cooperation within supply chain (in the form of, for instance, reduction of costs or increase in the volume of orders placed by customers). The direct effects of cooperation with other types of entities may be more difficult to point out or may manifest in a longer period.

Development of close relationships with customers is a key area of companies' operation, especially on business to business (B2B) markets (Fonfara 2004, p. 80, 116-121). Close cooperation with customers offers a wide range of benefits to companies. Firstly, it enables reduction of service costs. The retention of existing customers is much cheaper than winning new ones. Additionally, it enables the development of a product offer tailored to individual needs of customers thanks to including them in

product development processes. It also facilitates the development of customer loyalty (Hollensen, 2003, p. 202-223). In turn, cooperation with suppliers can lead to a significant reduction of costs thanks to the implementation of appropriate logistic solutions, just-in-time delivery or joint product improvements etc. (Hollensen 2003, p. 223-231).

The empirical analysis of 74 high-tech companies carried out in 2007 confirmed that high-tech companies which perceived their results better than these of their competitors utilised the relations established within the supply chain more intensively (Ratajczak-Mrozek, 2010).

On the other hand, the analysis of the data from the simulation experiments carried out in 2012 showed that it is more profitable for high-tech companies to collaborate with enterprises which have greater capacities and can offer greater supply, which reduces the number of supply chains. (Kawa, Ratajczak-Mrozek, 2012). This analysis was carried out on the basis of a developed model based on the graph theory, the business network concept and the competitiveness indicator (an average of the four results – profit, market share, sales volume and ROI). Four tiers of enterprises have been distinguished. The first tier was represented by a high-tech flagship company followed by assemblers, suppliers, and factories. The flagship company initiates the configuration of supply chain which is induced by the final customer. Therefore, it was assumed that supply chains were created for the needs of a specific transaction induced by the customer's demand.

Cooperation within supply chain versus competitiveness and growth of companies – empirical research

Data collection and sample characteristics

Data was obtained from a survey conducted between February and June 2011^[1]. The questionnaire was sent by mail. The address list was prepared on the basis of a national data base by the company Kompas Poland. The dataset included companies representing all industries from all over Poland, including high-tech companies. The sample was selected randomly, which made it possible to generalise on the whole population. Out of 192 answers the data concerning high-tech companies operating abroad has been chosen. The paper presents the data concerning 62 high-tech companies.

Delimitation of high-tech sector is based on the concept of industry and the name "high-tech" is given to companies (production and service) which belong to selected industries in accordance with the Eurostat classification. These industries are: manufacture of basic pharmaceutical products; manufacture of office machinery and computers; manufacture of radio, television and communication equipment and apparatus; manufacture of medical, precision and optical instruments, watches and clocks; manufacture of aircraft and spacecraft; post and telecommunications; and information technology.

1 The Research Project "Development of business networks in a company internationalization process" financed by Poland's Ministry of Science and Higher Education, 2010-2012, project leader K. Fonfara.

Almost 80% of the research sample was made up of micro, small and medium-sized enterprises (according to the criterion of 249 employees), whilst:

- 50% were medium enterprises,
- 22.5% – small enterprises,
- 6.5% – micro enterprises.

The remaining 21% were large and very large enterprises. Private entities definitely dominated (over 90% of the sample). The size and ownership structure of the surveyed companies is consistent with the structure of the entire Polish high-tech industry, which is mainly made up of small and medium-sized enterprises.

The characteristic of the surveyed high-tech companies in terms of the course of their internationalisation process is interesting. It is so much important as the further presented analysis concerns cooperation of high-tech companies with foreign entities, i.e. in the aspect of operation on the global market. Most of the surveyed companies (72%) have run international operation for at least 3 years, meaning that they already have some experience as regards activity on the international arena and that they should have proper experience in contacts with foreign entities.

Undoubtedly the applied forms of internationalisation are dominated by direct export (67.7% of the surveyed companies), subcontracting (43.5%), and indirect export (30.6%). Each time non-capital and capital cooperation as well as own direct investments are carried out by less 15% of the analysed high-tech companies. In the future the analysed companies plan to turn towards more advanced forms of internationalisation (an increase in non-capital and capital cooperation, and direct investments) and turn away from the forms which to a less degree encompass advanced knowledge transfer (especially indirect export and subcontracting).

Data analysis

The first stage of the analysis includes the analysis of an average assessment of the importance attached by all surveyed high-tech companies to cooperation with particular types of foreign entities from the perspective of the companies' performance (see Table 1).

Table 1. The importance of cooperation with particular types of foreign entities for the high-tech companies performance

Entities	Score
Customers	4.38
Suppliers	3.95
Competitors	2.61
Business agents	3.38
Influential entities	2.73

Answer scale: 1 – hardly important, 2 – little important, 3 – no opinion, 4 – important, 5 – very important

On average vertical cooperation within successive links of supply chain (suppliers, business agents, and customers) is of the greatest importance for the achieved results amongst all the analysed high-tech companies. On the other hand, influential entities and competitors get the lowest assessment. These results are compatible with the general trend observed on the market and confirmed by previous research, whilst in this case they relate not so much to the fact of cooperation itself as to its effects.

The next stage of the analysis deals with identification of company groups with varying approaches to cooperation within supply chain. The division is carried out based upon the analysis of responses pertaining to the assessment of the importance of the significance ascribed to cooperation with various foreign entities within supply chain for the company's performance. An average assessment of the importance of cooperation with three types of foreign entities is taken into account: customers, suppliers, and business agents. This is the basis for distinguishing two groups within the analysed high-tech companies:

- SCHigh, i.e. companies ascribing great importance for their performance to cooperation within supply chain (an average assessment of cooperation with customers, suppliers and subcontractors ≥ 4.0), 34 companies in total;
- SCLow, i.e. companies ascribing little importance for their performance to cooperation within supply chain (an average < 4.0), 27 companies in total.

The two distinguished groups represent a relatively similar number, which is important in view of further analysis and making comparisons.

Taking into account the two groups of high-tech companies with different approaches to the assessment of the importance of the significance ascribed to cooperation with various entities within supply chain for their performance, an attempt to verify whether these approaches have any bearing on the growth and competitiveness of these companies can be made.

With a view to assessing the growth and competitiveness of the companies, financial and non-financial company's performance indicators, which cover profit, return on investment (ROI), sales volume and market share achieved by the respondents, were analysed:

- in 2010 compared with 2007 (the analysis of growth),
- in 2010 compared with these of the closest competitors (the analysis of competitiveness).

Due to the difficulties in comparing companies with different characteristics (taking into account such elements as size, ownership, and industry), a subjective assessment method of comparison was adopted based upon the relative assessment of the companies themselves. The application of such an evaluation method facilitates the comparison of companies with different characteristics in terms of their overall performance. The adaptation of this evaluation method is based upon the earlier research (Fonfara, 2010; Fonfara, 2012).

The 5-point Likert scale was used for the assessment. The respondents, by answering the questions in the questionnaire relating to four aspects of their

performance (profit, ROI, sales volume, and market share) were to provide their own self-assessment in relation to their closest competitors or the year 2007 (1 – considerably worse, 2 – worse, 3 – almost the same, 4 – better, 5 – considerably better). A score above 3.0 means that the company deemed its performance to have been better than this of its competitors or recorded a performance growth (compared to 2007). It should be noted that due to the applied scale the relative differences in rating may seemingly appear to be rather small. It is, however, largely caused by a small dispersion of the minimum and maximum rating (1 – 5).

Table 2 presents the average results for the above-mentioned financial and non-financial indicators of high-tech companies' performance in terms of growth and competitiveness and the division by the two indicated varying approaches to cooperation within supply chain.

Table 2. Financial and non-financial indicators of high-tech companies' performance in terms of growth and competitiveness

Performance indicator	SCHigh		SCLow	
	N	Score	N	Score
Growth (performance indicators in relation to year 2007)				
Profit	29	3.76	25	3.52
ROI	29	3.52	25	3.20
Sales volume	29	3.66	25	3.56
Market share	29	3.52	25	3.52
Average of four performance indicators	29	3.62	25	3.45
Competitiveness (performance indicators in relation to the closest competitors)				
Profit	20	3.85	19	3.37
ROI	20	3.60	19	3.05
Sales volume	21	3.57	19	3.21
Market share	22	3.45	20	3.20
Average of four performance indicators	20	3.62	18	3.21

N – The number of responses regarding the specific performance indicator

Answer scale: 1 – considerably worse, 2 – worse, 3 – almost the same, 4 – better, 5 – considerably better

The results presented in the above table indicate a very distinct trend. In terms of both growth (in relation to 2007) and competitiveness (in relation to the closest competitors), within each of the analysed performance indicators, the high-tech companies ascribing great importance for their performance to cooperation within supply chain (SCHigh) achieve higher results compared to the companies ascribing little importance to this cooperation (SCLow). The only exception is the market share, where both analysed groups record the same results, meaning that the analysed high-tech companies ascribing great importance to cooperation within supply chain demonstrate a higher growth as well as the level of competitiveness than the companies, which do

not ascribe such importance (of course, from the perspective of their own assessment of the performance).

The carried out analysis confirms that cooperation within supply chain is an important basis for the strategy aimed at assurance of growth and competitiveness of high-tech companies. At the same time, it should be repeated that cooperation within supply chain is not the sole factor influencing the company's growth. However, the analysis aims to confirm a certain tendency, and not statistical interrelations.

Conclusions and further research

The analysis carried out in the article proved that global business networks, and especially cooperation within supply chain, is an important basis for the growth strategy of high-tech companies, bearing in mind that supply chain forms an important part of a global business network. The necessity for treating cooperation and building network relations at a global scale as permanent elements of the strategy should be stressed. Only such approach to cooperation and global business networks may assure possibly sustainable growth.

However, the analysis is not free of certain limitations, which simultaneously suggest further areas of study. First of all, the questions connected with the adopted industrial criterion of high-tech companies' delimitation arise. Although it is a generally adopted criterion, which is most useful in surveys, one should be aware that the category of "industry" is broad enough to encompass individual companies applying technologies which are advanced to various degrees, and companies characterised by different degrees of innovativeness or involvement in research and development. There is a possibility that technologically advanced companies are found outside the listed industries and, on the other hand, not much technologically advanced entities are encountered within them. Secondly, it would be important that further research encompass a comparison of the results of the presented analysis with the answers of companies representing traditional industries, which would enable one to show how specific the indicated solutions are to solely high-tech industries.

It may be anticipated that the issues connected with cooperation and global business networks will be more and more important, both in economic practice and in the cognitive sphere, hence it is crucial to continue research in this area.

References

- Ancarani, F., Shankar, V. (2003), *Strategic Alliances And Customer Interactions In Convergent Industries*, Paper presented at the 19th IMP-conference, Lugano, Switzerland.
- Anderson, J., Håkansson, H., Johanson, J. (1994). Dyadic Business Relationships Within a Business Network Context. *Journal of Marketing*, 58 (10).
- Barry, J.M., Dion, P., Johnson, W. (2008). A Cross-Cultural Examination of Relationship Strength in B2B Services. *Journal of Services Marketing*, 22 (2).

- Blankenburg, D. (1995). A network approach to foreign market entry. In: K. Möller, D.T. Wilson (Eds.), *Business marketing: an interaction and network perspective*. USA: Kluwer Academic Publishers.
- Christopher, M., Payne, A., Ballantyne, D. (2002). *Relationship marketing. Creating stakeholder value*. Oxford: Butterworth Heinemann.
- Contractor, F.J., Kim, C., Beldona, S. (2002). Interfirm Learning in Alliance and Technology Networks: An Empirical Study in the Global Pharmaceutical and Chemical Industries. In: F.J. Contractor, P. Lorange (Eds.), *Cooperative strategies and alliances*. Amsterdam-Tokyo: Science.
- Cravens, D.W., Piercy, N.F., Shipp, S.H. (1996). New Organizational Forms for Competing in Highly Dynamic Environments: the Network Paradigm. *British Journal of Management*, 7 (3)
- Davies, P.N., Koza M.P. (2001). Eating soup with a fork: how informal social networks influence innovation in high-technology firms, *Strategic Change*, 10 (2).
- DeBresson, C. (1996). Why innovative activities cluster. In: C. DeBresson (Ed.), *Economic Interdependence and Innovative Activity. An Input-Output Analysis*. Cheltenham: Brookfield.
- D'Cruz, J.R., Rugman, A.M. (1993). Developing international competitiveness: the five partners model, *Business Quarterly*, 8 (2).
- Drucker, P. (1985). *Innovation and entrepreneurship: practice and principle*. London: Butterworth-Heinemann.
- Easton, G. (1992). *Industrial Networks: a Review*. In: B. Axelsson, G. Easton (Eds.), *Industrial Networks. A New View of Reality*, UK: Routledge.
- European Commission (2003). *Observatory of European SMEs 2002– High-tech SMEs in Europe*. European Commission.
- Fonfara, K. (2004). *Marketing partnerski na rynku przedsiębiorstw*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Fonfara, K. (Ed.) (2009). *Zachowanie przedsiębiorstwa w procesie internacjonalizacji. Podejście sieciowe*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Ford, D. (1984). Buyer-Seller Relationships in International Industrial Markets. *Industrial Marketing Management*, 13 (2).
- Ford, D., Håkansson, H., Johanson, J. (1986). How Do Companies Interact?. *Industrial Marketing and Purchasing*, 1 (1).
- Gadde, L.E., Snehota, I. (2000). Making the Most of Supplier Relationships. *Industrial Marketing Management*, 29 (4).
- Glabiszewski, W., Sudolska, A. (2009). Rola współpracy w procesie kształtowania konkurencyjności przedsiębiorstwa. *Organizacja i Kierowanie*, 2.
- Golicic, S.L. (2007). A comparison of shipper and carrier relationship strength. *International Journal of Physical Distribution & Logistics Management*, 37 (9).
- Gorynia, M., Jankowska, B. (2008). *Klasy a międzynarodowa konkurencyjność i internacjonalizacja przedsiębiorstwa*. Warszawa: Difin.

- Håkansson, H., Havila, V., Pedersen, A.C. (1999). Learning in Networks. *Industrial Marketing Management*, 28 (5).
- Håkansson, H., Johanson, J., Wootz, B. (1976). Influence Tactics in Buyer-Seller Processes. *Industrial Marketing Management*, 5.
- Håkansson, H., Lundgren, A. (1995). Industrial networks and technological innovation. In: K. Möller, D.T. Wilson (Eds.), *Business marketing: an interaction and network perspective*, USA: Kluwer Academic Publishers.
- Håkansson, H., Snehota, I. (1989). No business in an island: the network concept of business strategy. *Scandinavian Journal of Management*, 5 (3)
- Hollensen, S. (2003). *Marketing Management. A Relationship Approach*. Harlow: Financial Times Prentice Hall.
- Jarillo, J.C. (1988). On Strategic Networks. *Strategic Management Journal*, 9 (1).
- Jarillo J.C. (1995). Strategic networks. *Creating the borderless organization*. USA: Butterworth Heinemann.
- Johansson, M. (2001). *Searching the known, discovering the unknown, The Russian Transition from Plan to Market as Network Change Process*. Uppsala: Uppsala Universitet.
- Johanson, J., Mattsson, L.G. (1988), *Internationalisation in Industrial Systems – A Network Approach*. In: N. Hood, J.E. Vahlne (Eds.), *Strategies in Global Competition*, New York: Croom Helm.
- Johnson, J.E. (2004). Factors Influencing the Early Internationalization of High Technology Start-ups: US and UK Evidence. *Journal of International Entrepreneurship*, 2 (1/2).
- Karagozoglu, N., Lindell, M. (1998). Internationalization of Small and Medium-sized Technology-Based Firm: An Exploratory Study. *Journal of Small Business Management*, 36 (1).
- Kawa, A., Ratajczak-Mrozek, M. (2012). Supply Chain Configuration in High-Tech Networks. In: J.-S. Pan, S.-M. Chen, N.T. Nguyen (Series editors), *Lecture Notes in Artificial Intelligence LNAI 7196*, (pp.459-468). Berlin Heidelberg: Springer-Verlag.
- Kay, J. (1993). *Foundations of corporate success. How business strategies add value*. Oxford: Oxford University Press.
- Kennedy, A., Keeney, K. (2006). *Strategic partnerships and the internationalization process of software SMEs*. Paper presented at the 32nd EIBA Annual Conference, Fribourg, Switzerland.
- Li, J., Lam, K., Qian, G. (2000). High-tech industries and competitive advantage in emerging markets: a study of foreign telecommunications equipment firms in China. *The Journal of High Technology Management Research*, 10 (2).
- Madsen, T.K., Servais, P. (1997). The internationalization of born globals: an evolutionary process?. *International Business Review*, 6 (6).
- Niedbalska, G. and others (1999). *Definicje pojęć z zakresu statystyki nauki i techniki*, Warszawa: Główny Urząd Statystyczny.
- OECD (2000). *A New Economy? The changing role of innovation and information technology in growth*. OECD.

- Plawgo, B. (2005). Przesłanki i formy powiązań kooperacyjnych przedsiębiorstw. In: B. Plawgo, W. Zaremba (Eds.), *Partnerskie współdziałanie w sektorze publicznym i prywatnym*, Białystok: Fundacja Współczesne Zarządzanie.
- Ratajczak-Mrozek, M. (2010). *Sieci biznesowe a przewaga konkurencyjna przedsiębiorstw zaawansowanych technologii na rynkach zagranicznych*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
- Ratajczak-Mrozek, M. (2012). The premises for establishing business networks in the internationalisation process (research project 2010-2012). In: K. Fonfara (Ed.), *The development of business networks in the company internationalisation process* (pp. 71-81), Poznań: Poznań University of Economics Press.
- Ring, P.S. (1996). *Networked Organization, A Resource Based Perspective*, Uppsala: Uppsala University.
- Sapienza, H.J., Autio, E., George, G., Zahra, S.A. (2006). A capabilities perspective on the effects of early internationalization on firm survival and growth. *Academy of Management Review*, 31 (4).
- Schwens, C., Kabst, R. (2006). *How early internationalizers learn: experience of others and paradigms of interpretation*. Paper presented at the 32nd EIBA Annual Conference, Fribourg, Switzerland.
- Spence, M. (2003). International Strategy Formation in Small Canadian High-Technology Companies – A Case Study Approach. *Journal of International Entrepreneurship*, 1 (3).
- Sudolska, A. (2008). Stan i potrzeba współpracy przedsiębiorstw w Polsce. In: W. Popławski, A. Sudolska, M. Zastempowski, *Współpraca przedsiębiorstw w Polsce w procesie budowania ich potencjału innowacyjnego*, Toruń: Dom Organizatora.
- Thomas, R., Ford, D. (1995). Technology and networks. In: K. Möller, D. T. Wilson (Eds.) *Business marketing: an interaction and network perspective*. USA: Kluwer Academic Publishers.
- Turnbull, P.W., Ford, D., Cunningham, M. (1996). Interaction, relationships and networks in business markets: an evolving perspective. *Journal of Business & Industrial Marketing*, 11 (3/4).
- Wilson, D.T., Mummalaneni, V. (1986). Bonding and Commitment in Buyer-Seller Relationships: a Preliminary Conceptualisation, *Industrial Marketing and Purchasing*, 1 (3).
- Wilson, H.I.M., Appiah-Kubi, K. (2002). Resource leveraging via networks by high-technology entrepreneurial firms. *The Journal of High Technology Management Research*, 13 (1).
- Wimmer, Á., Mandják, T., Esse, B. (2010). *Perception and practice of the supplier relationship management*. Paper presented at the 26th IMP Conference in Budapest, Hungary.
- Włosiński, K., Szerenos A.M. (2006). Kłustry wysokotechnologiczne na Mazowszu – wyniki badań. *Organizacja i Kierowanie*, 3.
- Żelazko, B. (2009)., Kooperacja firm biotechnologicznych w Polsce. *Kwartalnik Nauk o Przedsiębiorstwie*, 4.

Abstract (in Polish)

Specyfika profilu działalności przedsiębiorstw high-tech (zaawansowanych, wysokich technologii), w tym konieczność aktywności w skali międzynarodowej, sprawiają, że przedsiębiorstwa te mogą odnaleźć w kooperacji, relacjach sieciowych i sieciach biznesowych niezbędną determinantę wzrostu i konkurencyjności. Szczególnie interesującymi partnerami biznesowymi dla nich powinny być podmioty zagraniczne, często postrzegane jako reprezentujące bardziej zaawansowaną wiedzę, zasoby i doświadczenie.

Celem artykułu jest wskazanie globalnych sieci biznesowych (czyli obejmujących podmioty lokalne i zagraniczne), a w szczególności kooperacji z podmiotami tworzącymi łańcuch dostaw, jako istotnej podstawy strategii wzrostu przedsiębiorstw high-tech.

W artykule przyjęto optykę podejścia sieciowego (network approach) jako koncepcji współpracy przedsiębiorstw. Przedstawiono analizę kilku zarówno własnych, jak i wtórnych badań empirycznych, koncentrując się na przedsiębiorstwach high-tech zlokalizowanych w Polsce.

W szczególności zaprezentowano wyniki własnych badań przeprowadzonych wśród 62 przedsiębiorstw high-tech w Polsce w pierwszej połowie 2011 roku. Ukazano, że przedsiębiorstwa high-tech przypisujące duże znaczenie współpracy w ramach łańcucha dostaw wykazywały zarówno większy wzrost, jak i poziom konkurencyjności w porównaniu z przedsiębiorstwami nie przypisującymi dużego znaczenia tej współpracy (pamiętając przy tym że łańcuch dostaw stanowi ważną część sieci biznesowej). Podkreślono konieczność traktowania współpracy i kształtowania relacji sieciowych w wymiarze globalnym jako stałego elementu strategii przedsiębiorstw high-tech. Tylko takie podejście do współpracy i globalnych sieci biznesowych może zapewnić możliwie trwałą wzrost.

Słowa kluczowe: przedsiębiorstwa high-tech, sieci przemysłowe, sieć handlowa, podejście sieciowe, współpraca, zarządzania łańcuchem dostaw, konkurencyjność, wydajność spółki, strategia wzrostu.

Matching Imitative Activity of High-Tech Firms with Entrepreneurial Orientation

Marta Najda-Janoszka*

Abstract

As pointed by numerous scholars high technology sectors are very apt for studying entrepreneurial activities due to their high levels of innovativeness. However, taking into account the highly dynamic and substantially hostile environment in those sectors, innovation may often not be the best strategic choice for market entry. In fact, the business practice confirms the extensive utilization of imitation strategy by technology entrepreneurs. Meanwhile, the literature on entrepreneurship focuses almost exclusively on original innovators, underestimating the importance of imitation in the growth process and indicating shortage of research on imitative activities of entrepreneurs. Therefore this article presents discussion on the applicability of entrepreneurial orientation to imitators from the high-tech industries.

Keywords: imitation, high-technology firms, entrepreneurial orientation

Introduction

Rapid technological progress strengthens competitive pressure and creates a rich pool of technological opportunities that encourage entrepreneurial behavior of firms (Lindelof & Lofsten, 2006). However, taking into account the accelerating pace of imitation in high-technology sectors it has to be considered whether an entrepreneurial orientation should be assigned only to the first movers. In the literature entrepreneurship is tightly linked with innovation, in the sense that innovativeness represents the fundamental and necessary condition for the entrepreneurial orientation, yet the concept of innovation is not limited to the first practical use of the solution but also applies to products, processes, methods assimilated from other entities (Oslo Manual, 2005, p. 53). In fact, in high-tech industries the boundaries between the innovation and imitation are often blurred. Hence, following the pioneer does not eliminate risk of market entry and is not necessarily equal to lack of capabilities, weak market position or inability to recognize market opportunities. Nevertheless, the literature on entrepreneurship focuses almost exclusively on original innovators, underestimating the importance of imitation in the growth process and indicating shortage of research on imitative activities of entrepreneurs (Schmitz, 1989). Meanwhile the business practice confirms the extensive utilization of imitation

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strategy by entrepreneurs (Baumol, 1986 after: Schmitz, 1989, p. 722; Droege & Dong, 2008) - "while entrepreneurial activity focuses on actualizing promising opportunities, the strategies and actions by which many entrepreneurial firms do so are best described as imitation strategies" (Droege & Dong 2008, p. 51). This indicates the need for broadening the scope of theoretical analysis of entrepreneurial activity by including both strategic approaches to innovation. Since there are two alternative paths for seizing market opportunities, the key managerial decision concerns selecting the most appropriate strategy in a given context. The specificity of the highly innovative and dynamically growing high-tech industry calls for a particular attention in the subject area. Therefore this article presents discussion on the applicability of entrepreneurial orientation to imitators from the high-tech industries.

Entrepreneurial orientation concept in high-tech industry

Entrepreneurial orientation (EO) is based on the assumption that firms undertaking entrepreneurial activity can be distinguished from other firms by measurable features (Bednarczyk, 2010, p.19-31). Findings of early research indicated that entrepreneurial firms are more risk prone than other types of firms. Further additional features were developed such as entrepreneurs' need for achievement, internal locus of control (personality characteristics), strong emphasis on product innovation, aggressive competition with rival firms, proactive searching and seizing new business opportunities (Palich & Bagby, 1995, p. 427; Park, 2005, p. 741; Kreiser, Marino, Weaver, 2002, p. 73). The growing number of identified attributes and inconclusive empirical support for some of them called for an integrative approach in a form of a cohesive entrepreneurial orientation concept. The first conceptualization of EO was developed by Miller (1983), who defined an entrepreneurial firm as one that "engages in product market innovation, undertakes somewhat risky ventures and is first to come up with proactive innovations, beating competitors to the punch" (Miller, 1983, p. 771). This proposition was further adopted and operationalized by numerous researches. Among several propositions an operationalization developed by Covin and Slevin became the most widely utilized in entrepreneurship research (Covin & Slevin, 1988 after: Kreiser, et al. 2002; Droege & Dong, 2008). According to their suggestion the entrepreneurial orientation of a firm as an aggregate measure should be calculated by summing together the levels achieved by this firm in each of the three dimensions of the EO (Covin & Slevin, 1988, after Kreiser, et al. 2002):

- Innovation – in entrepreneurship literature innovation is recognized as the fundamental undertaking of the entrepreneurial organization. According to Covin and Miles (1999) innovation underlines all forms of entrepreneurship, representing the most important of the three dimensions. A strong commitment to the process of creating and introducing new value to the market distinguishes an entrepreneurial firm from organizations with different strategic orientation (Zahra, 1993, p. 47). Thus, in order to meet the criteria set for entrepreneurial organization a firm should develop a higher than a given

industry average number of new products or markets (Kreiser, et al. 2002, p. 74). Moreover, recent studies on entrepreneurial innovation increasingly include also non-technical innovations concerning new marketing and organizational methods, new business models.

- Risk-taking – while risk taking is attributable to any business activity, since all managerial decisions are risky because their outcomes are distant in time, entrepreneurial firms tend to be more risk prone than other firms. The observation that entrepreneurs are attracted to risky ventures with expected above-average outcomes formed the basis for the first formal theory of entrepreneurship (Palich & Bagby, 1995, p. 426). However, willingness to engage in risky ventures does not mean that entrepreneurs accept greater levels of uncertainty, rather they have lower risk perception (Palich & Bagby, 1995). “Entrepreneurs may not think of themselves as being any more likely to take risks than non-entrepreneurs, but they are nonetheless predisposed to cognitively categorize business situations more positively” (Palich & Bagby, 1995, p. 426). According to Simon, Houghton and Aquino (2000) the low level of perceived risk exhibited by entrepreneurs could be due to the cognitive biases such as overconfidence, illusion of control and belief in law of small numbers.
- Proactiveness – this dimension received significantly less attention in the entrepreneurship literature than the previous two (Kreiser, et al. 2002, p.78). Lumpkin and Dess (2001) define proactiveness as opportunity-seeking perspective involving aggressive interaction with the environment, in particular competitors. Therefore entrepreneurial proactiveness has two features: an aggressive competition with rival firms and an organizational pursuit of favorable business opportunities (Kreiser, et al. 2002, p. 78). Some researchers extracted competitive aggressiveness as a distinct dimension of EO but such approach did not receive a wider support in the literature (Droege & Dong, 2008). The studies confirmed that entrepreneurs are more active in seeking opportunity than corporate managers, as they have the capacity to see what others do not (Timmons, 1999, after: Park, 2005, p. 742). According to the literature a prior experience of an entrepreneur is the prominent factor of the opportunity recognition process (Shane, 2000) – between 50 and 90% of start-up ideas come from prior work experience (Hills, Shrader, Lumpkin, 1999, after: Park 2005, p. 742). Other potential factors mentioned in the literature such as personality traits and social networks require further research to confirm their validity (Park, 2005, p. 747).

Further studies focused on the development of the EO operationalization resulted in a fundamental change in hitherto widely adopted assumption. The research work conducted by Lumpkin and Dess (1996) and Kreiser et al. (2002) led to the conclusion that, although these three dimensions comprise a single measure, they equally represent individual components of EO having individual contributions to firm performance

as well as independent interactions with environmental variables. It undermined the commonly utilized assumption of uni-dimensional, aggregated character of EO measure by proving its multi-dimensionality (Kreiser, et al. 2002). Further, the strict requirement of exhibiting high levels of each dimension in order to be recognized as an entrepreneurial firm was significantly relaxed. It was found that various combinations of the three dimensions can equally shape the EO of a given firm. (Kreiser, et al. 2002; Lumpkin & Dess, 1996).

As pointed by numerous scholars, high technology sectors (*High...*, 2009) are very apt for studying entrepreneurial activities. In those sectors rapid technological change creates a rich pool of technological opportunities that encourages entrepreneurial firm-level behavior and enables the successful entry of new firms (Lindelof & Lofsten, 2006). According to Park (2005) in markets characterized by a rapid technology advancing barriers resulting from the lack of critical mass of newly established firms are practically negligible. However, as argued by Granstrand (1998) the high-technology firms face knowledge-based barriers since they need a specialized managerial knowledge to locate, mobilize, combine and exploit other resources in response to business opportunities. In dynamic technological markets entrepreneurial firms play a more prominent role than in sectors fully occupied by large firms with established knowledge base, R&D budgets, accumulated experience that enable engaging in large scale innovations (Park, 2005, p. 741). Due to the dynamic technology development emerging entrepreneurial firms can challenge established positions with good prospects of success. Indeed, often “radical new technologies render the competencies of incumbent firms obsolete leaving them locked into existing technological trajectories and outdated business propositions” (Cefis & Marsili, 2011, p. 478). This observation is consistent with the conclusion formulated by Sorensen and Stuart (2000), according to which aging is associated with increases in high-tech firms’ rates of innovations, but the scope of their innovative activities frequently becomes limited to local areas of expertise in particular domain of business activity and leads to competency traps thus threatening the environmental fit of those companies. In high-technology markets in order to innovate firms are forced to invest heavily in competence development in particular areas of technology which in turns causes strategic inertia on the adaptive potential of those firms to important changes in technological regimes (Sorensen & Stuart, 2000, p. 87). Nevertheless participation in the innovation race is a necessity for the firms operating in the high-tech industry even though it does not spectacularly improve their chances of survival (Cefis & Marsili, 2011). Those firms need to innovate just to maintain their positions (Cefis & Marsili, 2011). “High-tech firms work in a truly extreme environment where the technology challenges are often on the edge of scientific possibility, but with the available resources generally scarce” (Park, 2005, p. 741). In the academic literature these extreme external conditions are most often described by using environmental dynamism and environmental hostility dimensions. Environmental dynamism refers to “the rate of change and innovation in an industry as well as the uncertainty and predictability of the actions of competitors and customers” (Miller & Friesen, 1983, p. 222). According

to Khandwalla (1977, p. 27) a hostile environment is “a risky, stressful and dominating environment with precarious industry settings and intense competition”. Zahra and Neubaum (1998) identified four levels of environmental hostility:

- Macro level related to political, regulatory and economic conditions,
- Market level referring to unfavorable conditions that exist within the industry,
- Competitive level related to the intensity of competition in a given industry and aggressiveness of actions taken to gain opportunities,
- Technological level referring to radical changes in technological resources and capabilities available within the industry.

It is widely supported in the literature that highly dynamic environment, by creating numerous opportunities, provide a strong impetus to take risk (Covin & Slevin, 1991; Khandwalla, 1977). In case of hostility dimension the relationship between organizational risk-taking and level of environmental hostility tend to be curvilinear as the organizational risk-taking is the highest at moderate levels of environmental hostility (Kreiser). Extreme hostile conditions discourage firms from taking risks that would erode their profits. Equally benign environments do not provide incentives for risk-taking as conservative strategies ensure sustaining positions. Consequently, in highly dynamic and considerably hostile environments that characterize high-technology sectors quick and risky actions are necessary to maintain the chances of survival (Park, 2005). Technological companies facing such external adversity and abundance of opportunities are more likely to undertake entrepreneurial activities to deal with dynamic, hardly predictable changes (Zahra & Neubaum, 1998). Since effective opportunity recognition in the high-tech industries is determined by technology advancement and diversification, entrepreneurial firms pursuing business opportunities need to embrace this multidirectional technology development, “combine it with either new or existing market opportunities and continually evolve the technology with market or customer needs (Park, 2005, p. 745). One technology can give rise to multiple opportunities (Shane, 2000) as well as minor technology transferred from other business sector can become a high-value component of a spectacular new business venture (Park, 2005, p. 742).

Imitation as a market entry strategy

There are not many publications in which imitation is considered on par with other strategic options without negative connotation. The literature is dominated by dismissive attitude towards imitative activity of firms (Schmitz, 1989; Schnaars 1994; Shenkar, 2010; Schewe, 1996) even though imitation is “actually a much more prevalent road to business growth and profits” (Schnaars, 1994, p. 1). Thus, the business practice indicates that innovation and imitation are utilized as alternative pathways to successful business performance (Teece, 2002). Hence, the choice of market entry strategy should be considered in terms of managerial decision which involves in-depth analysis of potential benefits and drawbacks of each available option.

The limited attention devoted to imitation is primarily focused on illegal copying of original products. This adds up to a widespread bad impression of imitation

as a criminal activity and leaves out of sight a whole spectrum of different forms of imitative practices. The literature does not provide many sophisticated typologies of imitation that would reflect the diversity of such activity. The most common approach is to distinguish two main types: pure imitation (Lee, Zhou, 2012) or duplicative imitation (Luo, Sun, Wang, 2011) and creative imitation (Lee, Zhou, 2012) or innovative imitation (Luo et.al 2011). However according to Schnaars (1994) imitation is exercised in different forms that can be arranged along the creativity continuum with counterfeits on one extreme and original innovations involving the highest degree of creativity and experimentation at the other (Figure 1):

- Counterfeits – illegal duplicates carrying the same brand name or trademark as the original product;
- Knockoffs – close legal copies of original products carrying their own brand names developed due to absence or expiration of legal protection (patents, copyrights) of competitors' products;
- Design copies – copies of style, design of competitor's product carrying its own brand name and possessing its own unique engineering specifications, may be based on a unique and innovative technology;
- Creative adaptations – creative improvements of competitor's products, adaptations of existing ideas to new applications as well as truly innovative solutions merely inspired by competitor's offering.

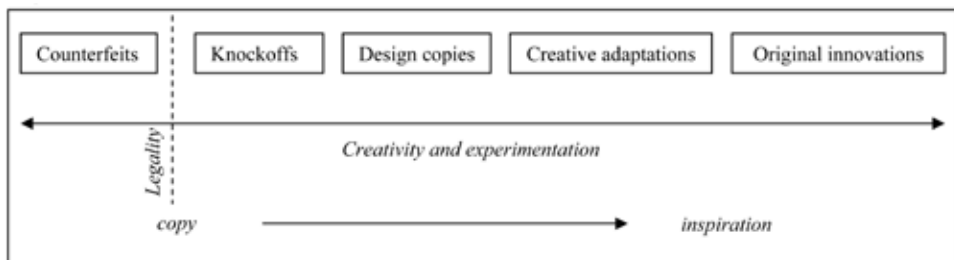


Figure 1. Imitation forms

Source: Author's own work based on Schnaars (1994).

The content of different kinds of imitative practices indicates the existence of potential for direct knowledge production that sometimes blurs the boundaries between imitations and original innovations (Schmitz, 1989; Shenkar, 2010). In the literature it is a widely used practice to reserve term innovator for a company that commercializes a novel value for the first time while launching this particular innovation in a new context by another company is recognized as an imitative behavior (Fagerberg, 2005, 8). However, according to approach presented in Oslo Manual the concept of innovation is not limited to the first practical use of the solution but also applies to product, processes, methods assimilated from other entities and adapted to a new context (Oslo Manual, 2005, p. 53). Consequently creative adaptations are often

equated with incremental innovations, whereas as pointed by Luo et al. (2011) these activities differ from each other since incremental innovations improve on a firms' own original product and creative adaptations add value to products introduced by other units. Nevertheless, assuming that "every new innovation consists of a new combination of existing ideas, capabilities, skills, resources" (Fagerberg, 2005, p. 10), it has not been defined at which point the creative adaptation ends and starts the novel innovation. Hence, the essential problem concerns proper distinguishing between related but distinct positions of pioneers, innovators, imitators and late market entrants. There are two main criteria used for the correct identification of them: the originality of the value created and introduced to the market, and the sequence in time of market entry (Schnaars, 1994, p. 12-13) (Figure 2).

	Innovator	Imitator
Pioneer	<p>The innovator is first to market with an innovative product.</p> <p>Rollerblades introduced the first in-line roller skates.</p>	<p>An imitator beats the innovator to market with an imitative product, typically while the innovator lingers in test marketing.</p> <p>Reynolds introduced the first ballpoint pen, which it copied</p>
Late	<p>One innovator is beaten to market by another innovator. Each has developed its new product independently.</p> <p>Matsushita's VCR entered after Sony's, but it was an innovative product in its own right.</p>	<p>The imitator enters the market after the innovator with a copy of the innovator's product.</p> <p>Diet Coke did it in low-calorie soft drinks.</p>

Figure 2. Imitation versus later entry

Source: (Schnaars, 1994: 12).

Thus, according to the resulting two-dimensional matrix imitators can be found among late entrants as well as pioneers when they manage to enter the market with copied solution before the original innovation passes the commercialization phase. Hence, being innovator does not exclude the possibility of late entry to the market. Parallel but independent development of a highly similar solution is not a rare case in business practice (Schnaars, 1994). Consequently, the distinction between imitators and late-entry innovators is not always clear. Equally difficult is to define a pioneer in actual case stories observed in high-technology industries where for one innovative category there is a bundle of potential pioneers in the pursuit of market success.

Undoubtedly achieving market success is the main goal of the market entry and, what is important, profiting from the new value is neither restricted nor guaranteed to first-movers. In fact economic reality indicates that an advantageous position of

pioneers, commonly proclaimed on the theoretical ground, is significantly overstated (Teece, 2002; Shenkar, 2010) (Table 1). As bluntly stated by Gibson “the trouble with being a pioneer is that the pioneers get killed by the Indians” (Schnaars, 1994, p. 20). It is not a rare case when shortly after a successful commercialization pioneer gets push out from the established market position by the followers (Teece, 2002; Shenkar, 2010; Schnaars, 1994). Unfortunately the majority of discussions on the problem of profiting from innovative value are narrowed to the innovator-pioneer perspective and focused on the value appropriation strategy based on the management of value protection mechanisms (Fischer, 2011; Teece, 2002). Since innovation process provide opportunities for both pioneers and followers (Teece, 2002, p. 123), there is an apparent deficit of research containing analyses of different market entry strategies treated as alternative pathways to market success (Lee, Zhou, 2012). Knowledge about the specificity of each alternative strategy forms the basis for managerial decision on selecting the most appropriate market entry strategy in the given internal and environmental circumstances.

Table 1. Advantages of first-movers and followers

First-movers	Followers
<ul style="list-style-type: none"> • Image derived from early entry • Creating brand loyalty • Technological leadership, experience effects • Setting product standards • Determining distribution channels • Legal protection of innovation 	<ul style="list-style-type: none"> • Image created through fast adapting to market development • Lowering the price and improving the quality through product upgrading, • Lower costs of educating customers • Technological leapfrogging • Avoiding lock-in with irreversible investments before development of the dominant design • lower R&D expenditures and shifting capital to marketing • use of knowledge leakages, inventing around, reverse engineering

Source: Author’s own work based on Schnaars (1994), Teece (2002).

The analysis of available research works on imitation and innovation allowed for identification of conditions forming a favorable environment for implementing the imitator strategy in high-tech sectors:

- *low degree of intellectual property protection* – The impact of intellectual property regimes is rather confined to a fairly narrow segment of the economy (Teece, 2002, p. 116). Hence, as declared by managers, the level of legal protection afforded to innovative products is in most cases ineffective (Mansfield, 1985; Fischer, 2011). An empirical study of Mansfield (1985) found that patents commonly recognized as the most powerful legal protection mechanism and a symbol of innovation, in practice are not a very challenging barrier to imitators. Within four years 60 percent of the patented products covered by the study have been copied (Mansfield, 1985). Therefore, an

extensive usage of patents in high-tech sectors is based not only on their limited protective power but even more likely due to their strategic function in strengthening the bargaining power of firms in cross-licensing. Developing high-tech products requires multiple sourcing of industry knowledge and building a wide patent portfolio protects firms more often against claims of intellectual property infringement rather than imitative practices of competitors (Fischer, 2011).

- *inherent immitability of the new value* – Advancement in information processing provides better perspectives for knowledge codification and further accelerates its transfer and diffusion. The greater range of codified knowledge about innovation the better chances for imitation (Teece, 2002). According to Mansfield (1985) information about new R&D projects tends to leak out to competitors within 12-18 months. Assuming that it takes on average three years to translate an idea into an innovative product ready for market introduction, then “there is a better-than-even chance that the decision [to innovate] will leak out before innovation is half-completed” (Mansfield, 1985, p. 219). The studies indicate that product and marketing innovations are more easily copied since their knowledge content is readily observable to competitors. In high-tech sectors it is a common practice to utilize reverse engineering to learn the new solutions. However, process innovations are more immune to such practices since being not as much visible they do not reveal how their unique characteristics have been obtained (Teece, 2002).
- *breakthrough innovation rendering existing industry standards obsolete* – Introducing a radical innovation to the market initiates the battle for setting the new industry standard (e.g. VHS – Betamax, HD-DVD – Blu-ray). An opportunity to set or have a significant contribution to a new industry standard attracts imitators since “the best initial design concepts often turn out to be hopelessly wrong” (Teece, 2002, p. 98). In their search for dominant design imitators modify the innovative product relying on the breakthrough solutions pioneered by the innovator. According to Teece (2002, p. 98) “when imitation is possible and occurs in conjunction with design modification before the emergence of a dominant design, followers have a good chance of having their modified product anointed as the industry standard, often to the great disadvantage of the innovator”. Once a dominant design emerges the competition shifts from design fundamentals to price, thus making again room for imitators that introduce improvements providing lower prices and/or better quality of the initial innovation (Teece, 2002, p. 97).
- *modularization of the innovators’ value chains* – Modularization lowers the threshold for entering technology and capital intensive markets (Shenkar, 2010, p. 48). The knowledge and resource base formerly maintained within the boundaries of the firm is being more and more dispersed through intensive usage of modularization and outsourcing strategies. Technological expertise

is therefore in the hands of module suppliers. Hence, modularity enables innovation at a distance from the focal firm (Henkel and Baldwin 2009). Thus, as observed in high-tech sectors in particular, by modularizing focal firms open itself up to potential competition from the module suppliers that may outperform the integrator (IBM – Microsoft, Intel) as well as to imitation from competitors contracting high value components from the same module suppliers (Henkel & Baldwin, 2009; Shenkar, 2010; Afuah, 2010).

- *access to complementary assets* – Technological innovations are characterized by strong functional interrelatedness and dependencies between their internal sub-systems and incumbent solutions. Therefore successful innovation requires a careful management of those linkages to complementary technologies, e.g. entering the market with new data storage technology requires availability of its complementary readers. In high-tech industries complementary assets are very often more important than the innovation itself (Teece, 2002, p. 108). Thus, possession or reliable access to specialized complementary assets significantly increases the potential of extracting profits from innovations. Since small pioneering firms rarely have at their disposal necessary specialized assets the richly endowed large later entrants in most cases prevail those small upstarts (Schnaars, 1994). “Because the market of complementary assets is itself riddled with imperfections, competitive advantage can be gained or lost on how expertly the strategy for gaining access is executed” (Teece, 2002, p. 25).

Taking into account the conditions presented above innovation may not be the best strategic choice for market entry. After deciding to follow and surpass the first-mover a potential imitator needs to define how to realize this goal, whether by offering lower prices than the pioneer, selling a superior product in terms of its functionality and quality, or using market power to prevail the smaller pioneer. As evidenced in case studies presented by Schnaars (1994) and Shenkar (2010) imitators most often utilize a combination of those three options.

Entrepreneurial orientation of high-tech imitators

A thorough observation of business activity in the high-tech industries leads to the conclusion that imitation is becoming more feasible, more beneficial and faster than ever before (Shenkar, 2010, p. 168). The impact of various imitative practices on knowledge diffusion and development of high-tech industries forces to consider the strategic function and orientation of imitators. Taking into account the characteristics of EO dimensions and the specificity of imitative practices utilized by high-tech firms it appears to be possible to assign the fundamental features of EO not only to the technological pioneers.

Considering the first EO dimension, the innovation, and the accelerating pace of technology advancing a very popular phrase comes to mind – “innovate or die”. Unfortunately, this is a somewhat misleading slogan suggesting existence of only one appropriate strategic path to success or even survival and disregarding imitation as an

ineffective activity of minor importance. Meanwhile “imitation is not only as critical as innovation to business survival and prosperity but is also vital to the effective exercise of innovation itself” (Shenkar, 2010, p. 4). By imitating firms provide evidence that there is more than one way to move forward and those alternative pathways provide opportunities for further improvements and innovations (Shenkar, 2010). While most definitions and discussions in the literature might suggest that entrepreneurial firms implement only radical and original innovations, their actual activity in many cases focuses on modification of existing products, services, processes and their incremental improvements (Droege & Dong, 2008, p. 55). Hence, working on existing products does not exclude the creativity and experimentation in searching for improvements that add significant value to the original product (Shenkar, 2010). “The subsequent improvements in an invention after its first introduction may be vastly more important economically, than the initial availability of the invention in its original form” (Kline, Rosenberg, 1996, p. 283, after: Fagerberg, 2005, p. 6). Those improvements, as presented in previous section of the article, can be introduced equally by original innovators and their followers. The results of Shenkar’s (2010) research confirms that “imitation is not a mindless repetition, it’s an intelligent search for cause and effect (Shenkar, 2010, p. 28). As Schmitz (1989) modeled, by implementing current knowledge through imitation entrepreneurs create new knowledge and “augment the existing stock of industry knowledge in a learning-by-doing fashion” (Schmitz, 1989, p. 724). Furthermore, in high-tech sectors it is often extremely difficult to clearly identify actual imitators and true original innovators. Developing complex electronic or software products involves a very broad sourcing from existing industry knowledge, to the extent that original innovations can and often do result from imitative activity (Park, 2005; Henkel & Baldwin, 2009, pp. 30-31). Even widely acknowledged innovators such as IBM, Apple, Microsoft, General Electric are also consummate imitators that use imitation to outmaneuver innovative competitors and benefit economically from inventions made by others (Shenkar, 2010; Schnaars, 1994). A good example of multiple sourcing in software-intensive systems is Java programming language of Sun Microsystems. When Sun decided to change its product to an open source software it turned out to be a very tedious task as commented by Sun General Counsel Mike Dillon: “Java Standard Edition contains about 6 million lines of code. [...] Our legal team [of 190 lawyers] had to go over it, line by line, and look for all copyrights marks and third-party involvements. Where Sun didn’t have the correct licenses, we had to contact the owners, one by one, and determine rights” (Henkel & Baldwin, 2009, p. 29-30). In most cases the majority of profitable innovations introduced to high-technology markets contains a strong dose of imitation. The visible illustration is the large number of patent infringement suits against market leaders (Fischer, 2011). In the high-tech sectors inspiration goes in both directions – imitations are driven by innovations and creative imitations foster innovations. Moreover, a currently observed trend of utilizing open innovation systems undoubtedly will lead to further fusion of innovation and imitation by blurring already fuzzy boundaries between them (Najda-Janoszka, 2011).

Nevertheless imitation is not always successful. Any form of a business activity is accompanied by risk of failure. Hence, the assumption that imitation reduces risk of the market entry is not always supported by the business practice. In fact, the follower strategy provides opportunity for lowering some kinds of risk (Schewe, 1996, p. 56) and at the same time substitutes for other types (Shenkar, 2010, p. 163). Research confirms that the costs of imitating are significantly lower than those incurred by innovators. A successful market entry performed by innovators requires higher expenditures by an average of 25 to 35 percent (Shenkar, 2010, p.161). Nevertheless costs incurred by the followers in high-tech industries are not trivial, since most successful imitators exhibit high levels of R&D activity, develop new projects on their own in order to develop necessary startup experience for the new ventures (Schnaars, 1994). Converting technological innovations into a copy that will preserve the favorable outcome observed in the original requires specialized knowledge and capabilities providing the view inside the innovative solution and ways to overcome its causal ambiguity (Shenkar, 2010, p. 159). There are many cases of the imitation failure or underperformance due to the lack of adequate capabilities necessary to understand and further copy the new technology, because “if you fail to decipher causality in the original model, it is virtually impossible to establish causality in the recipient system” (Shenkar, 2010, p. 160). Therefore technological imitators take a considerable risk by investing time, effort and capital in replication projects which in a halfway through their execution may turn out to be unfeasible. Hence, rapid technology progress renders innovative technologies obsolete sometimes even before the potential imitator manages to replicate them. The risk of such unproductive use of time and resources while operating on a highly dynamic and competitive market might jeopardize the existence of a firm. Similarly as for pioneers heavy and often irreversible investment in a particular technology lowers the incentive to develop other solutions that might prove more promising and thus increases risk of future growth of the imitator (Shenkar, 2010, p. 164). Further, patented innovations drive up imitation costs by an average of 11 percent (Mansfield, Schwartz, Wagner, 1981 after: Schnaars, 1994, p. 29) and raise the legal risk of possible patent infringement suits. Although inventing around the patent due to disclosure of the invention is time-consuming and costly, it provides modifications that avoid patent infringements. But in high-tech industries “it is often impossible to identify with certainty all patents that the product might infringe” (Baldwin & Henkel, 2009, p. 30). Therefore, replicating and improving complex, multi-sourced technological solutions may be as risky in terms of possible legal allegations as walking through a minefield. Furthermore, entering the market with an imitation involves a substantial investment in marketing areas – market research, advertising, promotion, distribution in order to convince customers to the new features added to the innovation, to overcome the brand loyalty to the original product and to reduce risk of preserving the image of a copycat (Shenkar, 2010; Schnaars, 1994). Analogically as in case of a pioneer, a follower introducing an imitation to the dynamic and highly competitive technology market may have to face the numerous group of other followers that worked in parallel on the same technological solution. Moreover, as evidenced in the literature followers of

pioneers are quite often further imitated and even surpassed by later entrants (Teece, 2002). Consequently innovators as well as imitators have to take into account the risk of imitation.

As presented in the previous part of the article entrepreneurial proactiveness has two features: an aggressive competition with rival firms and an organizational pursuit of favorable business opportunities (Kreiser, et al. 2002, p. 78). According to the literature high levels of competitive aggressiveness suggest implementing strategies based on imitation (Droege & Dong, 2008, p. 57). Thus observed accelerating pace of imitation and highly competitive environment in high-tech sectors corresponds precisely to the formulated assumption. Imitators exhibiting high level of competitive aggressiveness invest heavily to quickly overcome the advantages of pioneers and structure their tactics to address any vulnerabilities in pioneers' value creation processes (Droege & Dong, 2008, p. 57). Since competitive aggressiveness implies quick responses to rivals actions and pricing tactics modifications are the fastest to introduce they are the most common practice used by technology followers (Schnaars, 1994). In such dynamic and considerably hostile environment imitators operate under severe time and competitive pressure feeling the breath of other potential imitators and later entrants behind their back. Therefore imitators are less likely to become complacent, are more aware of game-changing technologies (Shenkar, 2010, p. 10). Technology imitators know that one innovative technology can give rise to multiple market opportunities (Shane, 2000). Proactiveness exhibiting in recognizing and sizing market opportunities does not require being first to the market (Lumpkin & Dess, 1996). In high-tech sectors often "the most successful entrant is not the first firm to enter but the first to enter when demand explodes" (Schnaars, 1994, p. 200).

Conclusions

The research findings, theoretical discussions presented in the literature as well as the observed business practice support the assumption that high-technology imitators can be characterized by entrepreneurial orientation. Imitators often present a proactive attitude in searching and pursuing business opportunities based on competitors' offering and aiming at challenging their positions on the market. Hence, following a high-technology innovator is a considerably risky path to market success. Building on existing innovation allows for reduction of some kind of risks while substituting them for other types. The greater complexity, causal ambiguity of the novel, multi-sourced technology, the higher risk of imitation failure. Imitation and innovation are intertwined processes, thus pioneers as well as followers bear the risk of further imitation. Considering the last but the fundamental dimension of EO, it has been observed that "what we think as a single innovation is often result of a lengthy process involving many interrelated innovations" (Fagerberg, 2005, p. 6). This observation is especially valid in the high-tech environment, where developing complex solutions requires multi-sourcing from existing knowledge base to the extent that original innovations often result from imitative activity. In the high-tech sectors inspiration

goes in both directions – imitations are driven by innovations and creative imitations foster innovations. Imitation often involves creativity, experimentation and knowledge creation in learning-by-doing fashion. The business practice exhibits a substantial impact of various imitative activities on knowledge diffusion and development of high-tech industries.

Naturally, not all followers in high-tech sectors exhibit the entrepreneurial behavior since there are different kinds of imitative activity and all of those types are widely utilized in business practice. Unquestionably, the further on the creativity continuum, the higher probability of entrepreneurial orientation of an imitator. Moreover, a highly competitive and dynamic environment forces high-tech companies to engage in numerous often concurrent projects, and for each of those projects a different market entry strategy can be utilized. Therefore it is possible for a firm to be considered an innovator and imitator at the same time. Hence, it seems to be more appropriate to analyze imitation and innovation strategies by focusing not on the firm but on particular projects carried out by that firm. This leads to another important reflection. Assuming that innovative approach is not always the best choice and the high-tech firms need to engage in a wide range of projects, then it is crucial to develop and master entrepreneurial capabilities that allow for effective developing and implementing both market entry strategies. Implementing and utilizing those capabilities enable transforming the incidental approach to imitation into strategic one, which is necessary in the face of high competition, rapid technology advancing and development of open innovation systems in high-technology sectors.

References

- Afuah, A. (2009). *Strategic Innovation: New Game Strategies for Competitive Advantage*, New York: Routledge.
- Bednarczyk M. (red.). (2010). *Przedsiębiorczość w turystyce. Zasady i praktyka*, Warszawa, Wydawnictwa Fachowe CeDeWu.
- Cefis E., Marsili O. (2011). Born to flip. Exit decisions of entrepreneurial firms in high-tech and low-tech industries. *Journal of Evolutionary Economics*, 21(3), 473-498.
- Covin J.G., Slevin D.P. (1991). A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship Theory and Practice*, 16(1), 7-25.
- Droege, S.B., Dong L.C. (2008). Strategic entrepreneurship: imitation versus substitution. *Journal of Small Business Strategy*, 19(1), 51-62.
- Fagerberg, J. (2005). Innovation: A Guide to the Literature. In: J. Fagerberg, D.C. Mowery, R.R. Nelson (eds.). *The Oxford Handbook of Innovation*. New York: The Oxford University Press.
- Fischer, T. (2011). *Managing Value Capture: Empirical Analyses of Managerial Challenges in Capturing Value*. Heidelberg: Gabler Verlag – Springer Fachmedien Wiesbaden GmbH.
- Grandstrand, O. (1980). Towards a theory of the technology-based firm. *Research Policy*, 27(5), 465-489.

- Henkel, J., Baldwin, C.Y. (2009). Modularity for Value Appropriation – Drawing the Boundaries of Intellectual Property. *Harvard Business School Working Paper* 09-097. ‘High technology’ and ‘knowledge based services’ aggregates based on NACE Rev.2, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf.
- Khandwalla, P.N. (1977). Some top management styles, their context and performance. *Organization & Administrative Sciences*, 7(4), 21-51.
- Kreiser, P.M., Marino, L.D., Weaver, K.M. (2002). Assessing the Psychometric Properties of the Entrepreneurial Orientation Scale: a Multi-Country Analysis. *Entrepreneurship Theory and Practice*, 26(4), 71-94.
- Lee, R.P., Zhou, K.Z. (2012). Is Product Imitation Good for Firm Performance? An Examination of Product Imitation Types and Contingency Factors. *Journal of International Marketing*, 20(3), 1-16.
- Lindelof, P., Lofsten, H. (2006). Environmental hostility and firm behavior – an empirical examination of new technology-based firms on science parks. *Journal of Small Business Management*, 44 (3), 386-406.
- Lumpkin, G. T., Dess, G. (1996). Clarifying the Entrepreneurial Orientation Construct and Linking it to Performance. *Academy of Management Review*, 21 (1), 135-172.
- Luo, Y., Sun J., Wang, S.L. (2011). Emerging Economy Copycats: Capability, Environment, and Strategy. *Academy of Management Perspectives*, 25(2), 37-56.
- Mansfield, E. (1985). How rapidly does new industrial technology leak out? *The Journal of Industrial Economics*, 34(2), 217-223.
- Miller, D. (1983). The Correlates of Entrepreneurship in Three Types of Firms. *Management Science*, 29 (7), 770-791.
- Miller, D., Friesen, P.H. (1983). Strategy-making and environment: The third link. *Strategic Management Journal*, 4, 221-235.
- Najda-Janoszka, M. (2011). Zatrzymywanie wartości w sieciach kooperacyjnych przedsiębiorstw. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu*, (169), 48 – 62.
- Palich, L.E., Bagby, D.R. (1995). Using Cognitive Theory to explain Entrepreneurial Risk-taking: Challenging the conventional wisdom. *Journal of Business Venturing*, 10(6), 425-438.
- Park, J.S. (2005). Opportunity recognition and product innovation in entrepreneurial hi-tech start-ups: a new perspective and supporting case study. *Technovation*, 25, 739-752.
- Schewe, G. (1996). Imitation as a strategic option for external acquisition of technology. *Journal of Engineering and Technology Management*, 13(1), 55-82.
- Schmitz, J.A. (1989). Imitation, Entrepreneurship, and Long-Run Growth. *Journal of Political Economy*, 97(3), 721-739.
- Schnaars, S.P. (1994). *Managing imitation strategies*, New York: The Free Press.
- Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organizational Science*, 11(4), 448-469.
- Shenkar, O. (2010). *Copycats*, Boston: Harvard Business Press.

- Simon, M., Houghton, S.M., Aquino, K. (2000). Cognitive biases, risk perception, and venture formation: How individuals decide to start companies. *Journal of Business Venturing*, 15(2), 113-134.
- Sorensen, J.B., Stuart, T.E. (2000). Aging, obsolescence, and organizational innovation. *Administrative Science Quarterly*, 45(1), 81-112.
- Teece, D.J. (2002). *Managing Intellectual Capital*, New York: Oxford University Press.
- Zahra, S.A. (1993). New product innovation in established companies: Associations with industry and strategy variables. *Entrepreneurship Theory and Practice*, 18(2), 47-69.
- Zahra, S.A., Neubaum, D.O. (1998). Environmental adversity and the entrepreneurial activities of new ventures. *Journal of Developmental Entrepreneurship*, 3(2), 123-140.

Abstract (in Polish)

Wielu badaczy potwierdza, że ze względu na wysoki poziom innowacyjności sektory wysokich technologii są wyjątkowo adekwatnym obiektem badawczym w zakresie studiowania działań przedsiębiorczych. Niemniej jednak dynamika i niestabilność otoczenia w tych sektorach sprawia, że innowacja to nie zawsze najlepsza strategia wejścia na rynek. W rzeczywistości praktyka gospodarcza wskazuje na szerokie wykorzystanie strategii imitacji przez przedsiębiorców sektorów technologicznych. Tymczasem literatura poświęcona przedsiębiorczości skupiona jest niemal wyłącznie na oryginalnych innowatorach i radykalnych innowacjach marginalizując znaczenie imitacji w procesie rozwoju na poziomie gospodarki, sektora jak i indywidualnych przedsiębiorstw. Istnieje zatem wyraźny niedobór badań nad wykorzystaniem imitacji w działaniach przedsiębiorczych. Dlatego niniejszy artykuł przedstawia dyskusję na temat możliwości przypisania przedsiębiorczej orientacji imitatorom funkcjonujących w sektorach wysokich technologii.

Słowa kluczowe: imitacja, wysokiej technologii firmy, orientacja przedsiębiorcza.

The Role of Academic Entrepreneurship and Spin-Off Companies in the Process of Technology Transfer and Commercialisation

*Irena Łącka**

Abstract

In developed countries, the academic entrepreneurship makes up a very important element of academic environment activities. For some time, the increase in the role of technology transfer and knowledge commercialisation has been also promoted in Poland. Strong connections between the scholarship and the economy (in the future, within the university of the third generation) have a chance to build an economy based on knowledge in our country. The flow of knowledge and the introduction of new solutions (results of scholarly research) in enterprises take place through the intermediary of various methods of transfer and commercialisation paths. Independent of the manner, each fulfils an important role in the public life and economy. This is confirmed by the experience of the States that are recognised as innovation leaders, and presented in the paper as examples of Polish scholars' academic entrepreneurship.

Keywords: academic entrepreneurship, technology transfer, commercialisation, spin-off companies, technological cooperation.

Introduction

Social and economic transformations in the world economy being under way for a few recent dozen years have caused a change in the development paradigm - in the modern theories of economic growth and development, the so-called innovativeness paradigm gained on importance. Following the increase in the share of knowledge and technological progress in production processes, people started to notice that the rate and quality of economic growth in the economy at the turn of the 20th and 21st centuries are determined by the knowledge and human capital, the creation of entrepreneurship with the use of a skilful transformation of research and development results into commercial solutions and the creation of advantageous institutional conditions for the innovation to occur. This can be found at every level of economy in micro–meso–macro scales.

The experience of developed countries, recognised as the leaders of knowledge-based economy (for instance, the Scandinavian countries, Germany, Great Britain,

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USA, Japan, Singapore and others) confirms that the development of contemporary economy and the increase in its competitiveness require a continuous application of technology, innovations and skills to commercialise scholarly knowledge. The scholarly research (basic, applied and development works), the transfer of technology and the cooperation between the university and the economy have become the basis for their achievements (Łącka, 2011). The essence of these connections is the transfer by scholars of technological and organisational knowledge and practical experience related thereto to entrepreneurs and their implementation by companies, so as to achieve economic benefits. New product processing, organisational and even social solutions facilitate an increase in the productivity of enterprises, an improvement in work efficiency and quality. They also foster the creation of new business entities (for instance, the so-called spin-off companies) new work places, new prospects for human business, the launching of new products into the market, the creation of new streams of demand and new markets, discovering new resources and the application of new methods for the use of the existing production factors (Transfer of technology and development 2004).

An efficient connection of scholarly research and business can be seen in enterprises based on knowledge, organised by scholars, which are to commercialise technology, technological knowledge and the skills acquired at their parent entity (university, research centre, or any other scholarly centre). In the countries which rank highest in innovativeness rankings (USA, Finland, Sweden, Japan, Singapore), the academic entrepreneurship and its entities (spin-off companies) are recognised as a very effective mechanism of the flow of scholarly research results into the economy. However, this is not the only way of knowledge and technology in-flow into enterprises. Another channel is created by means of various agreements on cooperation between scholars and entrepreneurs.

The system of technology transfer and knowledge commercialisation

An integral part of a well-functioning innovative system and a process of technological innovation is the technology transfer. It may have an internal character (the flow of knowledge and technology takes place within the State) and an external one (new solutions originate in foreign resources). The basis of economic growth and development of a given State should be its own potential in this field and an efficiently functioning system of technology transfer and commercialisation at the regional level (Matusiak, Guliński, 2010).

The crucial elements of this system are domestic private and public universities, scholarly and research units, research institutes belonging to private and public sectors, independent laboratories. These entities are active, using public and private funds for the research. The effects of their work in the form of scholarly results, patents, know-how and applications for the protection of inventions, become an internal resource of innovation, of which entrepreneurs and the economy may avail themselves.

Beside them, in the system, there are innovative entrepreneurs (they belong primarily to the sector of SME), and new spin-off (spin-out) technological companies. This group of entities handles the transformation of knowledge and new solutions into

market products and services. They adjust the projects of new solutions so as to be implemented in the economic practice.

Another very important element of the system are innovation centres which include technological parks and incubators, technology transfer centres, pre-incubators, academic incubators, which offer various types of support for the innovative process, and institutions that provide pro-innovative services. Their task is to spread out knowledge and skills amongst the participants of innovative processes. They ensure consultations that consist, among others, in finding out innovative features of a product or technology, a new organisational solution (noticing its innovative potential and market opportunities, carrying out technological audits, working out a development strategy for a company or a scholarly and research unit and their use of technology transfer or knowledge commercialisation). They also offer technical and housing support. This group of entities makes it possible to implement the intentions of the State, related to the support for innovativeness and entrepreneurship of economic entities in Poland (by means of organising system conditions and assistance programmes directed at entrepreneurs and scholars).

The creation and introduction of innovations requires a financial supply, that is why the institutions of financial support for innovations are a very important group of entities in the system of technology transfer, as they prepare an offer of special instruments for financing the innovative undertakings, and are characterised by a high level of risk and uncertainty (because of the specificity unattractive for bank institutions). They include such funds as seed capital, venture capital and business angel.

The system of technology transfer and knowledge commercialisation covers also institutions of market providers of consultation, training and information services. These entities act on commercial principles, calculating their services necessary to implement the process of technology transfer and commercialisation on market principles.

The above-mentioned entities enter into many interactions in the regional system. Among them, there are uni-directional or bi-directional flows - of information, knowledge, technology, skills and financial resources. The intensity of connections between scholarly and research institutions and the economy is conditioned by the operation of national and regional systems of innovation and the pressure of the market demand for new products, services, organisational and marketing solutions (Łącka, 2011).

The essence and stages of technology transfer

The transfer of technology is defined in the literature of the subject in a diversified manner which results, according to Nagrodkiewicz (2010), from the use of the word "technology" to describe the phenomenon whose semantic range is wider than that described by this word. This notion covers the field of technology, dealing with drawing up and carrying out most advantageous processes of manufacturing and raw materials, half-products and products processing in given conditions. This is the knowledge on processing in a purposeful and economic way of natural goods into usable goods (PWN

Encyclopaedia). With this approach, the technology does not refer to all operations related to manufacturing and processing of products, the entirety of technical and organisational innovations. Yet, the phenomenon of knowledge and technology flow has a wider context than putting technical solutions into practice. Similar objections may be noticed in the views of foreign authors, for instance Allen (1984), Rosenberg (1982) and Radosevic (1999).

An approach to the essence of the transfer of technology is the definition published in the paper "Innowacje i transfer technologii. Słownik pojęć" (Innovations and transfer of technology. Dictionary of terms) (Matusiak, 2005, p. 168). It says that: "it is the transfer of information necessary for one subject to be able to copy the operation of another subject. This information appears in two forms - of a technical nature (engineering, scientific knowledge, standards) and procedures (among others, legal procedures, agreements on confidentiality, patents, licences)". Koch understands the transfer of technology in a similar way. He acknowledges that it is: "a purposeful, directed transfer of knowledge and skills to a production process, with the purpose to successfully market the product obtained (Koch 1999). According to the UNCTAD (2001) experts, it is a flow of "systematic knowledge to create a product, apply a process or provide services but it does not cover [the transfer - author's note] of transactions which are limited exclusively to a sale or a lease of goods (following: Jasiński, Ludwicki, 2007, p.28).

The transfer of technology is also defined as a process of adjustment of the results of scholarly research, patents or original ideas to their practical application in manufacturing (Włosiński 2000). If we take into account the fact that innovations may also have a servicing and public nature, then, this notion becomes further widened.

For American experts of the TreMonti Consulting, LLC, the transfer of technology is a process of a formal transfer of the rights to use and commercialise new discoveries and innovations, arising from scholarly research to the other party (Staecker, 2010). In this approach, the process is initiated by the preceding stages which make the transfer of technology possible. They consist in:

- financing research works,
- obtaining research results – inventions,
- protection of intellectual property rights and managing them.

The latter aspect is particularly emphasized because of the potential to commercialise the research results and the necessity to assure the right of priority and the protection of innovations. As to the transfer of technology process, according to the American experts, it covers the following stages:

- evaluation,
- marketing,
- licensing and possibly implementation,
- monitoring.

During the evaluation, the market potential of the new solution is assessed with the help of a technological audit, the strategy for commercialisation is set

out and strong and weak sides of the innovative undertaking are determined. This stage facilitates making a decision on the way the new solution shall be used so as to bring about the largest possible benefits. In this case, the invention shall be treated not only as a scholarly value but also a potential economic benefit. This requires carrying out market and economic analyses which shall allow to compare the potential costs of protection for a given technological solution (for instance, costs of applying for the protection of exclusive rights and costs of its maintenance) with the potential profits that the invention process could generate in the next years. The analysis of this type is not easy to be carried out as it is difficult to evaluate the future benefits - their volume and value are uncertain and burdened with a significant risk. The forecasts are not always confirmed. Sometimes the introduction of the invention and the acquisition of acquirers take longer than it has been forecast. However, one may not give up the evaluation as it is a basis to take up further operations in the process of new solution commercialisation. This stage is also connected with the necessity to get a protection for the invention. The most suitable form of protection, its temporal and territorial range, shall be selected to reserve the exclusive rights.

After the protection application has been lodged, the communication with the market starts by means of marketing operations, together with the promotion of the new solution and the search for potential receivers. At this stage, the information on a given invention is published. The commercialising institute (for instance, Centre of Technology Transfer), attempts to present it in a simple, understandable language, showing the values of the new solution and potentials to use it. This type of information is published in printed promotional materials. Apart from that, other information distribution channels are used for publications (patent databases, technological quotation bases, conferences, exhibitions, shows and fairs, electronic mail, media, etc). A growth in the interest of businesses in the innovations follows, and they try to get in touch both with the commercialising institute and the inventor.

In the subsequent stage, the method of technology transfer shall be selected. In the case of a new solution, the transfer of scholarly research results may take place through licensing, sale, or a spin-off company. At the licensing stage, an agreement is prepared and concluded, allowing for the use of exclusive rights to the invention, utility design, industrial design, and topography of electronic circuit or master work which is the object of the copyright. The owner of the rights may decide to transfer them in return for benefits in the form of licence fees. An alternative for licensing is the sale of intellectual property (patents, material copyrights, know-how, or an independent further development of technology and the introduction of the new solution within the existent or newly created technological (spin-off) company. The variants of commercialisation methods of the results of research development works of university scholars are presented in Figure 1.

The decision on the selection of commercialisation methods of the new solution is conditioned upon several factors. They are, among others: legislation terms in

a given State (among others, those related to the indication who gets the right to the intellectual property), types and features of technology and the degree of its advance, the scope of intellectual property rights protection, the type of target market where it is to be used, financial potential of the subject (entrepreneur, university, institute, scholars), possible potential to get financial support from various sources and the readiness of the owner (a group of owners) of the invention to take up the risk of running business and to engage into running a spin-off company or into entering a joint-venture company (Shane, Cable, 2002; Shane, Stuart, 2002).

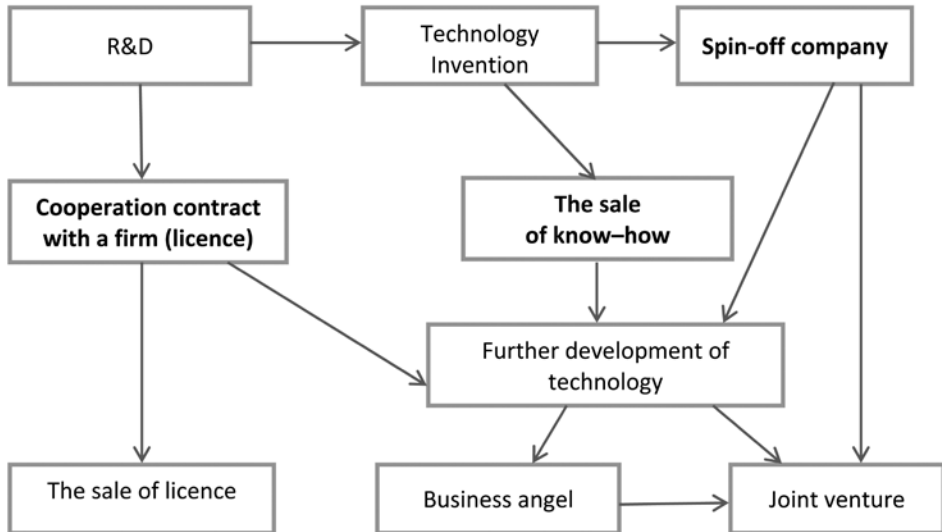


Figure 1. Ways of inventions commercialisation by universities and scholars

Independent of the selected methods of commercialisation, in the end a new solution is introduced in the market, which may be completed by means of acceptance of a given technology, product or service, etc. in the market. If the new solution is accepted by the buyers, then the commercialisation is deemed successful. Its confirmation shall be getting profits from sales, licence fees, revenues from know-how, etc. At this stage, a permanent monitoring of financial benefits gained from the intellectual property rights shall be carried out together with the control of duties being fulfilled by the licences.

American and European understanding of academic entrepreneurship

In recent years, in particular since the reform of the scholarship and research in Poland, a significant interest in the subject of academic entrepreneurship has grown, also with reference to the impact on the functioning of scholarly and research units, the creation of connections between scholars and entrepreneurs, technology transfer and knowledge commercialisation and innovativeness of Polish economy and its

entities (Guliński, Zasiadły, 2005; Tamowicz, 2006, Bąk, Kulawczuk, 2009; Łącka, 2011). This is the result of the discussion on the necessity to have a deep transformation in the model of functioning of Polish universities and scholarly and research institutes, as well as their relation with the economy. The discussion is still on with reference to the introduction of the model of third generation universities in Poland, which is supposed to join three purposes of their operation - education, scholarly research and technology commercialisation (Wissema, 2005).

As indicated by Cieślak (Tomtas, Anders, 2005), this term is used in various sources (expert opinions, scholarly articles, official documents) in an ambiguous manner. In the American approach (Shane, 2004), the academic entrepreneurship is reflected directly in the creation of new enterprises (spin-off companies). This notion designates entities created by the members of the academic community to commercialise and transfer technology which makes up an element of intellectual property, created in the parent academic institution. Such a narrow perception of academic entrepreneurship is characteristic of American literature (Smilor et al, 1990; Radosevich, 1995; Powers, McDougall, 2005). Sometimes this notion is narrowed even more, to the engagement of scholars, with the exclusion of students and graduates) in forming the so-called professors' companies.

Polish experts define the spin-off or spin-out companies in a similar manner (these two terms are frequently used interchangeably) (Matusiak, 2005). This type of enterprises comes into being as a result of an employee/employees of the parent company or a scientific or research institute, institution or research laboratory becoming independent and creating a business, using intellectual, material and organisational resources of the parent institution. A spin-off or spin-out company may have various relations with the parent scholarly institution (no formal connections, licensing agreements, university capital share in the company in return for making the intellectual property rights available).

Yet, in Europe, the academic entrepreneurship is described in much broader terms. The notion is understood as any involvement of scholarly institutions, their academic, auxiliary and administrative employees, students preparing doctor's thesis and students in the economic business and the creation by these entities of any companies (not necessarily using intellectual property). Such an approach to the academic entrepreneurship results from the inclusion of universities into the group of institutions which have an impact on shaping the entrepreneurship (Guliński, Zasiadły, 2005). In this case, the academic entrepreneurship includes any enterprise formed by a person connected in any way to a university, also an enterprise that is not formed for the purpose of technology commercialising.

The differences between the European and American approaches result from a lower level of entrepreneurship in Europe and the necessity to support the pro-entrepreneurial attitudes in the European population. Because of this, the academic entrepreneurship is defined in a wide approach as the whole spectrum of procedures with reference to supporting the relations between the scholars and the economy,

pre-incubators and incubators of enterprises, originating from scholarly entities. The variety of spin-off companies phenomenon taken into account, Nicolaou and Birley defined three spin-off groups which differ from one another in terms of the manner in which the owner, the university and intellectual property are involved, (Nicolaou, Birley, 2003). The following types can be distinguished amongst them:

- orthodox type - the enterprise bases its functioning on a scholar-inventor, and the technology transferred,
- hybrid type - the company uses the technology transferred whereas scholars and other persons engaged in the enterprise may be still within the university and in the company they are, for instance, members of scholarly board (consulting function), supervisory board (control function),
- technological type - the spin-off company uses the technology transferred from the university, however, on principle of cooperative technology transfer, and the scholar has no contact with the newly formed company; the inventor may, however, have his shares or offer his consultation services.

The European approach to the academic entrepreneurship and its manifestations is reflected in official documents related to the use of aid resources from the European Union within the Human Capital Operating Programme. These resources are designated to support various projects of academic entrepreneurship (the creation of spin-off companies included). In the case of spin-off companies, they are not only limited to those which use intellectual property generated in the parent university. The only thing which is emphasized is the fact they should commercialize innovative solutions, the knowledge or technology. There is no requirement to use protected knowledge (by a patent or in another manner) which was generated in the scholarly entity. Companies may be founded not only by scholars and Ph.D. students but also students and graduates in the period of 12 months after graduation. In particular, in the case of the latter group, it is difficult to accept that they found companies based on protected technology (Cieřlik, 2009).

While trying to get out of this notional chaos and to take into account the specificity of Polish economy (weakly developed entrepreneurship and innovativeness, strong dependency on the European Union's aid for the pro-innovative and entrepreneurial activities) the application of holistic approach to academic entrepreneurship is recommended together with its various manifestations. This means including in this notion various entrepreneurship activities of university scholarly staff and also shaping the entrepreneurial orientation of students and graduates (preparing them to found their own companies based on the knowledge acquired during their studies). Enterprises may be founded by students and graduates during their studies or after graduation. These subjects may start their business related to the knowledge acquired while studying at the university or related to a completely different field. The business of the scholarly staff refers both to the spin-off companies (defined in a narrow sense) and the cooperative forms of technology transfer. These may be contracts related to carrying out research and development works, as commissioned by the industry, joint

launching, joint research with an industrial partner or technological consulting (Cieślak, 2009; Łącka, 2011).

Micro–meso–macro impact of academic entrepreneurship

All forms of so understood academic entrepreneurship lead to knowledge transfer and commercialisation into the economy, although it needs to be the knowledge covered by protective rights. Most phenomena related to the technology transfer and knowledge commercialisation do not have the nature of spin-off companies, even in the developed countries (Guliński, Zasiadły, 2005; Tamowicz, 2006). Moreover, one should not expect a dynamic development of this form of entrepreneurship either in developed countries, or in Poland. The support of academic entrepreneurship may be helpful. However, many other factors determine the readiness of scientists or Ph.D students to undertake their business, particularly charged with such a high risk. Fortunately, the inflow of scholarly research results to the economy also takes place by means of other forms of academic entrepreneurship. Spin-off companies are only one form of their manifestations. Apart from that, the transfer takes place within technological cooperation of scholars and research workers with entrepreneurs (broadly understood as contracts related to scholarly and research cooperation, launching, contract research, licences, patents and know-how sale by universities to businesses, exchange of the staff, consultations, etc).

The transfer and commercialisation of knowledge and technology exert a multi-dimensional impact on micro–meso–macroeconomic levels. University employees together with Ph.D students and graduates, make available to third party persons and institutions (primarily entrepreneurs) their knowledge, infrastructure and research results through the intermediary of various forms of knowledge and technology transfer and commercialisation. Their launching into the market (innovations) allows to strengthen the competitive position of the existing companies, to create new enterprises and as to entrepreneurs, scholars and institutes of the research and development sector, to obtain many benefits of economic, organisational and strategic nature (Łącka, 2011).

We should not forget the positive effects of various connections between scholarly and research entities and the companies of the region and the State. In the mesoeconomic aspect, they foster the regional development. They contribute, among others, to an increase in the number of enterprises and innovative companies in the region (the Small and Medium-Size Enterprises included), to the growth of companies' local expenses for development and research works, together with innovations, to a growth in the number of those employed in the existing enterprises and to found new workplaces, as a result of company business diversification, to attract new investors, to increase the proceeds from local taxes, to reduce the migration of residents to other regions.

The macro-economic aspect taken into account, the impact of the academic entrepreneurship, among others: on the development of the domestic scholarship,

directed to the commercialisation of its results, the improvement of the scholarship position in the world rankings, the appropriate allocation of public and private funds, designated to research development and innovative business, the development of the existing industry and services sectors and new fields of economy based on knowledge, the growth in the number of enterprises and employment in the State, the increase in the proceeds from taxes in the budget, the development of modern education system at each of its stages.

Technology transfer and commercialisation within the academic entrepreneurship in Poland - examples

Academic entrepreneurship, technology transfer and knowledge commercialisation through its intermediary are still weakly developed in Poland. It was only recently, following financing from the European Union funds between 2007 and 2013, and after a group of acts reforming the education system^[1] entered into force in 2010, that an intensification of actions intended to increase the activity of scholarly community in the field of technology transfer occurred. However, even in this situation, we can find examples of connections between scholars and entrepreneurs which make possible the research results flow to the economy. The research of Łącka (2011) proved that only in a few cases, the technology transfer took place through the intermediary of spin-off companies, founded for this purpose. Most frequently, it was implemented within various cooperation contracts between scholars and entrepreneurs. This cooperation was started most frequently during the performance of target projects, reported primarily by universities and research institutes (referred to earlier as development and research entities). Their partners in these projects were Small and Medium-Sized Enterprises, and the research results were launched in these enterprises. The limited framework of this paper taken into account, only a few of such examples may be presented.

Technology transfer within the cooperation between technical universities together with research institutes scholars and “PZL-Rzeszów” Wytwórnia Sprzętu Komunikacyjnego S.A.

In 2003, a group of 18 entrepreneurs of the aviation industry in the south-east of Poland (Podkarpacie Region), decided to found an industrial cluster in the aviation industry, named Aviation Valley (Dolina Lotnicza). The Rzeszow University of Technology adhered to this initiative, together with its well-developed Faculty of Machine Construction and Aviation. One of the purposes for this cluster was to cooperate and develop the aviation industry and universities, scholarly and research

1 Act of 15th June 2007 on the National Centre for Research and Development, Journal of Laws of 2007 No. 115, item 789; Act of 30th April 2012 on the guidelines for financing education, Journal of Laws of 2010 No. 96, item 615; Act of 30th April 2010 on the National Centre for Research and Development, Journal of Laws of 2010 No. 96, item 616; Act of 30th April 2010 on the National Science Centre, Journal of Laws of 2010 No. 96, item 617; Act of 30th April 2010 on science institutes, Journal of Laws of 2010 No. 96, item 618; Act of 30th April 2010 on Polish Academy of Sciences, Journal of Laws of 2010 No. 96, item 619.

institutes. They were to carry out research in the field of new concepts for the needs of its members and to develop the research and development sector in the aviation industry. The centre of advanced technologies "AERONET - Aviation Valley (Dolina Lotnicza) - founded in 2004, acting as a consortium was to serve this task. It was founded by the Rzeszow University of Technology (coordinator), Lublin, Łódź, Silesian, Warsaw Universities of Technology, The University of Rzeszow and the Aviation Valley Association. Later, the consortium was also joined by the Aviation Institute of Warsaw, Institute of Fundamental Technological Research Polish Academy of Sciences, The Institute of Fluid-Flow Machinery Polish Academy of Sciences, the Air Force Institute of Technology, and the Czestochowa University of Technology. As a result of this cooperation, the Polish Aeronautical Technology Platform was also organised.

Currently, the cluster is made up of 72 enterprises, with 21K employees and the sales amounting to over 1 000 000 000 USD per annum. Amongst them, there is the founder - "PZL-Rzeszów" WSK S.A. For many years, this enterprise has been cooperating with universities (long time before the Aviation Valley came into being) which run research works for the needs of the company. The technological partnership with the Warsaw and Silesian Universities of Technology, and the Institute for Ferrous Metallurgy had a significant importance when PZL-Rzeszów WSK was carrying out a job for General Electric, an American company, which produced engines for Embraer, Brazilian aircrafts.

This was connected to the manufacturing of engine turbine blades, as commissioned by the General Electric. It was a very difficult order because of the necessity to manufacture the parts very precisely and to comply with very high quality requirements. Its implementation was possible, owing to the cooperation with experts from both universities and the Institute for Ferrous Metallurgy. The cooperation on the projects took two years. PZL-Rzeszów WSK was manufacturing the blades which were then sent to scholars, to check their operation. After a cycle of tests, they indicated the necessary changes in the technology and together with the enterprise they elaborated methods for acceptance tests of the produced blades. The transfer of knowledge and technology made it possible to generate a product which corresponded to the high requirements of the American contractor. Thus, the commercialisation of a new solution took place.

The positive experience coming from the cooperation with Polish scientists encouraged the company to start up other joint undertakings with scholars. One of them was the project to start up manufacturing of hydraulic conduits, designated for most types of modern aircrafts and helicopters (military and civil ones), for instance (F-16, Boeing 737, Boeing 747, Boeing 757, Mc Donnell Douglas DC-10, Airbus A300, Airbus A310. PZL-Rzeszów WSK became the subcontractor of the American company. They were supposed to be also used by other world companies such as: Pratt & Whitney Canada, R.R. Donnelly, Snecma and General Electric.

The Polish company from Rzeszów needed a scientific and research support that would allow them to satisfy the requirements of the aviation equipment receivers, with

reference to soldering connections, with the use of vacuum soldering and induction soldering technology. For this purpose, it concluded a scientific research cooperation contract with the Production Engineering Plant of the Warsaw University of Technology and with the Institute of Precision Mechanics in Warsaw. The cooperation allowed to develop and implement on a production scale the technologies for hydraulic conduits soldering with various types of connecting union pieces (based on the solders of the Ag-Cu-Ni and Au-Ni types).

Technology transfer and commercialisation within spin-off companies

An example of the use of spin-off companies for technology transfer and commercialisation is Cemat Silicon S.A. It is a classic example of an orthodox spin-off company with the application of technology transferred to the company. It was founded in consequence of a research cooperation of a group of scientists from the ITME Institute of Electronic Materials Technology in Warsaw with "Cemat" Company while producing crystal silica and silica plates (by Czochralski method). These products make up a basis for printed circuits in electronic processors. In 1992, the technological cooperation brought about a spin-off company, in which ITME has 20% of shares. This company exports its whole production and has a leading position in the world market. It still co-operates with ITME in Warsaw, improving the technology and production methods.

Another spin-off company was a result of a lack of interest of domestic entrepreneurs in the possibility to launch a technology prepared by scholars. Employees of the Fertilisers Research Institute in Puławy, within research and development works, invented a modern method of hop extraction and pelleting, for the needs of breweries. The Puławy Institute, within the target project, developed an industrial process of hop pelleting and extraction. Unfortunately, this industry in Poland being taken over by foreign capital groups together with the change in production technology brought about the elimination of Polish hop producers. This caused no possibility to find a company interested in launching the new solution.

This situation encouraged the employees of the Institute to take up the risk and organise a spin-off company. At its own cost, the company (having incurred a loan) built, equipped and launched the production line. Thus, a new factory was created based on its own modern production technology which manufactures hop extract of the highest quality parameters for Polish breweries and exports it. Its production covers the hop extract demand of Polish breweries completely, and the quality of the products contributes to conquering the foreign markets. The implementation of this undertaking and the decision adopted on founding the spin-off company prevented the collapse of Polish hop farms - our country is the third hop producer in Europe.

A good example of technology transfer from the academic world to the economy is the business of READ-GENE S.A. spin-off company (professors' company) whose president is the Szczecin geneticist, prof. Jan Lubiński. The company was founded in 2005 by scholars of Hereditary Cancer Centre of the Pomeranian Medical Academy

PAM (currently Pomeranian Medical University PUM), directed by prof. J. Lubiński. Since 2009, the company has been noted at the Securities Exchange in Warsaw (the New Connect Market). It handles the methods of detection, prevention and treatment of the most widespread malignant cancers. Since 2011, the company has continued research on the impact of various micro and macro elements and vitamins on cancer affliction and on drawing up new dietary supplements.

From the very beginning, READ-GENE S.A was founded with the target of an international scale business and the selection of the organisational and legal form was to serve this purpose together with the business model. Its basis is the commercialisation of the results of the company's own research and scientific technology generated by the International Hereditary Cancer Centre (MCND) and the Centre of Genetics and Pathomorphology of the Pomeranian Medical University (PUM) in Szczecin. Pursuant to the licence agreement, signed with PAM in December 2005, READ-GENE S.A. company obtained the access to the technology generated within PAM. The licence agreement ensures to the company the exclusivity of technology commercialisation, composed of patents, a base of biological specimens and clinical data of patients registered in MCMD, trading secrets, know-how (Annual report 2012). The university is receiving 20% of the company's proceeds from sales.

Conclusion

The development of the economy based on knowledge in Poland requires a closer cooperation between the scholarship and the economy, as well as an intensive knowledge and technology transfer and the commercialisation of scholarly research results. In this process, an active role of scholars and scholarly and research institutions within academic entrepreneurship is necessary. This can be implemented in the form of technological companies (spin-off, professors' companies) founded by scholars. They decide to run a risky business, using the intellectual property of the university. Another very common manner of technology transfer and commercialisation consists in starting the cooperation between the scholarly and research employees and entrepreneurs in the form of contracts on cooperation with reference to research and development, contract research, licenses, the use of know-how, implementation, consultations, etc.

The academic entrepreneurship has an advantageous impact on the economy in micro–meso–macro scale. The technological cooperation of the scholarly environment with the economy and the direct activity of its representatives for the creation of spin-off companies, contribute to an increase in the innovativeness and entrepreneurship of the economy. This is also confirmed by the examples of technology transfer presented in the paper in various forms of academic entrepreneurship.

References

- Allen, T. (1984). *Managing the flow of technology*. MIT Press: Cambridge.
- Bąk, M., Kulawczuk, P. (red.). (2009). *Przedsiębiorczy Uniwersytet. Praktyczna użyteczność badań naukowych i prac badawczo-rozwojowych. Projektowanie i prowadzenie badań naukowych we współpracy z gospodarką*, Instytut Badań nad Demokracją i Przedsiębiorstwem Prywatnym: Warszawa (Entrepreneurial university. Practical usability of scholarly research together with research and development works. Drafting and carrying out scholarly research in cooperation with the economy. Institute for Private Enterprise and Democracy, Warsaw).
- Cieślak, J. (2009). *Przedsiębiorczość akademicka – próba syntezy podstawowych pojęć*, w: Tomtas-Anders A. (red.). 2009. *ABC przedsiębiorczości akademickiej*, Fundacja Rozwoju Regionów ProRegio. Poznań (Academic entrepreneurship – an attempt at synthesising basic notions, in: Tomtas-Anders A. (ed.). (2009). *ABC of academic entrepreneurship*, ProRegio Foundation for Regional Development, Poznań).
- PWN Encyclopaedia. <http://encyklopedia.pwn.pl/haslo.php?id=3985955>.
- Guliński, J., Zasiadły, K. (red.). (2005). *Innowacyjna przedsiębiorczość akademicka – światowe doświadczenia*, PARP: Warszawa (Innovative academic entrepreneurship – Word expertise, PARP, Warszawa).
- Jasiński, A. H. Ludwicki, D. (red.). (2007). *Metodyka transformacji wyników badań naukowych do zastosowań praktycznych. Raport, Studia i Materiały nr 1*. Wydział Zarządzania Uniwersytetu Warszawskiego. Uniwersytet Warszawski: Warszawa. (Transformation methods of scholarly research results into practical applications. Report, studies and materials No. 1, Faculty of Management of the Warsaw University, Warsaw University: Warsaw).
- Koch, J. (1999). *Rola uczelni technicznych w transferze technologii*. Pryzmat nr 116, marzec http://pryzmat.pwr.wroc.pl/Pryzmat_116/116koch.html. (The role of technical universities in technology transfer. Pryzmat No. 116, March, http://pryzmat.pwr.wroc.pl/Pryzmat_116/116koch.html).
- Łącka, I. (2011). *Współpraca technologiczna polskich instytucji naukowych i badawczych z przedsiębiorstwami jako czynnik wzrostu innowacyjności polskiej gospodarki*. Wydawnictwo Uczelniane Zachodniopomorskiego Uniwersytetu Technologicznego w Szczecinie: Szczecin (Technological cooperation of Polish scholarly and research institutions with enterprises as a factor for the growth of Polish economy's innovativeness, West Pomeranian University of Technology Publishing House in Szczecin, Szczecin).
- Matusiak, K. B. (red.). (2005). *Innowacje i transfer technologii. Słownik pojęć*. PARP: Warszawa. (Innovations and technology transfer. Dictionary of terms. PARP: Warsaw).
- Matusiak, K.B., Guliński, J. (red.). (2010). *Rekomendacje zmian w polskim systemie transferu technologii i komercjalizacji wiedzy*. PARP: Warszawa. (Recommendations for changes in the Polish system of technology transfer and knowledge commercialization. PARP: Warsaw).

- Nagrodkiewicz, A. (2010). Transfer technologii - źródło innowacji w przedsiębiorstwie. *Bulletin Euro Info*, kwiecień, <http://www.een.org.pl/index.php/spis/items/kwiecien-2010.html>. (Technology transfer - a source of innovations in the enterprise. *Biuletyn Euro Info*, April, <http://www.een.org.pl/index.php/spis/items/kwiecien-2010.html>).
- Nicolaou, N., Birley, S. (2003). Academic networks in tricotomous categorisation of university spinouts. *Journal of Business Venturing*, 18, 333-359.
- Powers, J. B., McDougall, P.P. (2005). University start-up formation and technology licensing with firms that go public: a resource-based view of academic entrepreneurship. *Journal of Business Venturing*, 20, 3, 291-311.
- Radosevic, S. (1999). *International technology transfer and catch-up economic development*, Edward Elgar: London.
- Radosevich, R. (1995). A model for entrepreneurial spin-offs from public technology sources. *International Journal of Technology Management*, 10, 7-8, 879-893.
- Annual Report, 2011. Read Gene S.A. (2012). <http://www.newconnect.pl>.
- Rosenberg, N. (1982). *Perspectives on technology*, Putmans, New York.
- Shane, S., Cable, D. (2002). Network ties, reputation and the financing of new ventures. *Management Science*, 48, 3, 364-381.
- Shane, S., Stuart, T. (2002). Organizational endowments and the performance of university start-ups. *Management Science*, 48, 1, 154-170.
- Shane, S. (2004). *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Edward Elgar Publishing: Cheltenham, UK, Northampton, MA, USA.
- Smilor, R.W., Gibson, D.V., Dietrich, G.B. (1990). University spin-out companies: technology start-ups from UT Austin. *Journal of Business Venturing*, 5, 63-76.
- Staecker, H. (2010). Technology audit, prezentacja przedstawiona 23.05.2010 r. podczas panelu ekspertów zagranicznych w ramach zajęć II edycji Studium Podyplomowego „Innowacyjne zarządzanie systemem B+R w jednostkach naukowych”, WSISiZ, Warszawa. (Technology audit, paper presented on 23rd May 2010 during a foreign experts' panel within the 2nd edition of post-graduate studies „Innovative management of research and development system in scholarly entities”, WSISiZ, Warsaw).
- Tamowicz, P. (2006). *Przedsiębiorczość akademicka. Spółki spin-off w Polsce*. PARP: Warszawa. (Academic entrepreneurship. Spin-off companies in Poland. PARP: Warsaw).
- UNCTAD. (2001). *Compendium of international arrangements on transfer of technology*. United Nations: New York.
- Ustawa z dnia 15 czerwca 2007 r. o Narodowym Centrum Badań i Rozwoju. DzU z 2007 r., nr 115, poz. 789. (15th June 2007 Act on the National Centre for Research and Development. *Journal of Laws of 2007 no. 115, item 789*.)
- Ustawa z dnia 30 kwietnia 2010 r. o zasadach finansowania nauki. DzU z 2010 r., nr 96, poz. 615. (30th April 2010 Act on Principles of Scholarship Financing. *Journal of Laws of 2010, no. 96, item 615*).

- Ustawa z dnia 30 kwietnia 2010 r. o Narodowym Centrum Badań i Rozwoju, DzU z 2010 r., nr 96, poz. 616. (30th April 2010 Act on National Centre for Research and Development. Journal of Laws of 2010. no. 96, item 616).
- Ustawa z dnia 30 kwietnia 2010 r. o Narodowym Centrum Nauki, DzU z 2010 r., nr 96, poz. 617 (30th April 2010 Act on National Centre for Research and Development. Journal of Laws of 2010, no. 96, item 617).
- Ustawa z dnia 30 kwietnia 2010 r. o instytutach badawczych, DzU z 2010 r., nr 96, poz. 618 (30th April 2010 Act on Research Institutes. Journal of Laws of 2010, no. 96, item 618).
- Ustawa z dnia 30 kwietnia 2010 r. o Polskiej Akademii Nauk, DzU z 2010 r., nr 96, poz. 619. (30th April 2010 Act on Polish Academy of Sciences. Journal of Laws of 2010, no. 96, item 619).
- Transfer technologii a rozwój. (2004). w: Negocjacje w transferze technologii, tł. z j. ang. J. Tłoczko, M, Lasota, J. Rafałowski. UNIDO, Warszawa (Technology transfer and development. (2004), in: Negotiations in technology transfer, translated from English. J. Tłoczko, M, Lasota, J. Rafałowski. UNIDO, Warsaw).
- Wissema, J.G. (2005). Technostarterzy, dlaczego i jak? PARP: Warszawa (Technostarters, why and how? PARP: Warsaw).
- Włosiński, W. (2000). Transfer technologii. Forum Akademickie, nr 4, http://www.forumakad.pl/archiwum/2000/04/artykuly/22-okolice_nauki.htm. (Technology transfer. Academic forum, no. 4, http://www.forumakad.pl/archiwum/2000/04/artykuly/22-okolice_nauki.htm.)

Abstract (in Polish)

Przedsiębiorczość akademicka w krajach wysokorozwiniętych stanowi bardzo ważny element aktywności środowiska naukowego. Od pewnego czasu postuluje się także w Polsce zwiększenie jej roli w transferze technologii i komercjalizacji wiedzy. Silne powiązania nauki i gospodarki (w przyszłości w ramach uniwersytetu trzeciej generacji) mają być szansą na zbudowanie w naszym kraju gospodarki opartej na wiedzy. Przepływ wiedzy i wdrażanie nowych rozwiązań (rezultatów badań naukowych) w przedsiębiorstwach może następować za pośrednictwem różnych metod transferu i ścieżek komercjalizacji. Niezależnie od sposobu, każdy pełni niezaprzeczalnie ważną rolę w życiu społeczeństwa i gospodarki. Potwierdzają to doświadczenia krajów uznawanych za liderów innowacji, ale także przedstawione w opracowaniu przykłady przedsiębiorczości akademickiej polskich naukowców.

Słowa kluczowe: przedsiębiorczość akademicka, transfer technologii, komercjalizacja, spin-off, współpraca technologiczna

Internal Factors of Academic Entrepreneurship: the Case of Four Malaysian Public Research Universities

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*LeilanieMohd Nor****

Abstract

This paper focused on academic entrepreneurship, an emerging phenomenon in Malaysian public research universities. The research demonstrated that academic entrepreneurship produced positive impact on research commercialization and university technology transfer for these public research universities. Academic entrepreneurship was also found to be one of the missing gaps in fulfilling the complete process of research and development up to commercialization. This study provided evidence of the appropriateness of using an organizational framework of academic entrepreneurship to measure the influence of the internal environment in stimulating the level of academic entrepreneurship. The results demonstrated that control systems, organizational culture, human resource management systems and entrepreneurial leadership behaviour were key predictors of academic entrepreneurship in these universities.

Keywords: Entrepreneurship, Corporate Entrepreneurship, Academic Entrepreneurship, Internal Environment, University Technology Transfer, Public Research Universities

Introduction

Academic entrepreneurship is an emerging phenomenon of interest in Malaysian public research universities. It is important because the development of academic entrepreneurship should have a positive impact on research commercialization and university technology transfer for these public research universities. Further, academic entrepreneurship is one of the missing gaps in fulfilling the complete process of research and development up to commercialization. In this study, academic entrepreneurship is articulated as the process of creating economic value through acts of organizational creation, renewal, or innovation that occurs within or outside the

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university that results in research commercialization and technology transfer (Yusof et. al., 2009; 2010).

Academic entrepreneurship is a process that occurred within the organizational boundary of the university and it facilitated and encouraged university technology transfer between the university and the industry. Consequently, a higher degree of academic entrepreneurship orientation will result in a greater number of technology transfer activities between the university and the industry. This research was pursued with the view that universities which integrate teaching and research with innovation and entrepreneurialism unleash and provide a vast resource that can be used for the betterment of the supporting and surrounding communities and industries.

With a focus on organizational context and the internal environment, this study examined the internal factors of academic entrepreneurship in Universiti Malaya (UM), Universiti Sains Malaysia (USM), Universiti Kebangsaan Malaysia (UKM) and Universiti Putra Malaysia (UPM) by adopting the corporate entrepreneurship lens and measured academic entrepreneurship as an organization-level construct. An organizational framework was constructed on the theory that internal factors which comprise of control systems, structure, human resource management systems, culture and entrepreneurial leadership behavior influence academic entrepreneurship in a university setting. More specifically, the research aimed to:

- investigate the nature of relationship between the internal factors and the level of academic entrepreneurship in the four public research universities, and,
- propose an organizational model of academic entrepreneurship.

Literature review

The literature review for this research was done extensively, encompassing an exploration of the field of entrepreneurship, organizational entrepreneurship and academic entrepreneurship. Most importantly, the review and examination of literature was directed towards describing the internal factors that may influence academic entrepreneurship in a university setting; and identifying the dimensions and elements of academic entrepreneurship. In the literature, other than individual entrepreneurs, researchers had posed concepts of teams and organizations as entrepreneurs. There were also efforts to relate entrepreneurship to values and value added concepts.

Entrepreneurship research began to focus on different units of analysis, ranging from individuals and teams to organizations and communities. Entrepreneurship research varied in context examined, such as new firms and organizations, existing corporations, family businesses, franchises and new international entrepreneurial activity. Due to this development, there was concern about how entrepreneurs act and the managerial behavior of the entrepreneur (Bygrave & Hofer, 1991; Stevenson & Jarillo, 1990; Meyer et. al., 2002; Shane & Venkataraman, 2000; Busenitz et. al., 2003; Schildt et. al., 2006; Gregoire et. al., 2006; Morris et. al., 2008).

The consideration of how entrepreneurs act gave entrepreneurship a practical point of view and led towards the application of entrepreneurship to organizations. This also led to the extension of the corporate entrepreneurship view from merely the study of internal venturing to the study of the ability of organizations to act entrepreneurially (Stevenson & Jarillo, 1990). Corporate entrepreneurship has become a distinct theme in entrepreneurship research and one of the most cited, densely populated and coherent groups of prior studies. It is also one of the streams in entrepreneurship research which has obtained conceptual convergence. These findings were supported by studies published in *Entrepreneurship Theory and Practice* in May 2006 issue which conducted bibliometric analyses on entrepreneurship-related literature (Schildtet. al., 2006; Gregoireet. al., 2006). In this regard, corporate entrepreneurship was deemed apt to be the background theory for this study.

This study was built on previous and emerging corporate-based literature within the overall discipline of entrepreneurship to explain the nature of academic entrepreneurship. The corporate entrepreneurship perspective was preferred because it offers an alternative to the traditional perspective of entrepreneurship that is centered on the role of the individual and the sequential stages of organizational development as posited by organizational life cycle theory. Further, the perspective has the potential for better understanding the organizational context, institutional setting and the dynamic nature of the academic entrepreneurship phenomenon (Brennan et. al., 2005; Brennan and McGowan, 2006; Llano, 2006, Wood, 2011, Clarysse et. al., 2011).

In addition, the study identified three research categories of university-level entrepreneurship namely 'entrepreneurial university', 'academic entrepreneurship' and 'university technology transfer' in the literature. At times, these concepts have been used interchangeably (O'Shea et. al., 2004, Powers and McDougall, 2005). Previous research and studies on entrepreneurial university, academic entrepreneurship and university technology transfer had been concerned and focused on institutional policies, the organizational and institutional environment, the individual academic entrepreneur and the relationship between the university and its external environment. The research contributed to the literature by delineating the boundaries of university-level entrepreneurship and developed a framework to depict the relationship between the research categories as shown in Figure 1 (Yusof and Jain, 2010).

Synthesizing and evaluating the literature, the research articulated the relationship between the entrepreneurial university, academic entrepreneurship and university technology transfer as follows:

- An entrepreneurial university is a university that strategically adapts the entrepreneurial mindset throughout the organization and extensively practices academic entrepreneurship which is extended beyond the boundary of the entrepreneurial university through university-industry technology transfer activities.

- Academic entrepreneurship is a process that begins within the organizational boundary of the university. This suggests that an entrepreneurial university can be compared to a less entrepreneurial one by measuring the level of its academic entrepreneurship.
- Academic entrepreneurship facilitates and fosters university technology transfer between the entrepreneurial university and the industry. Thus, a higher degree of academic entrepreneurship orientation will result in a greater number of technology transfer activities between the university and the industry.

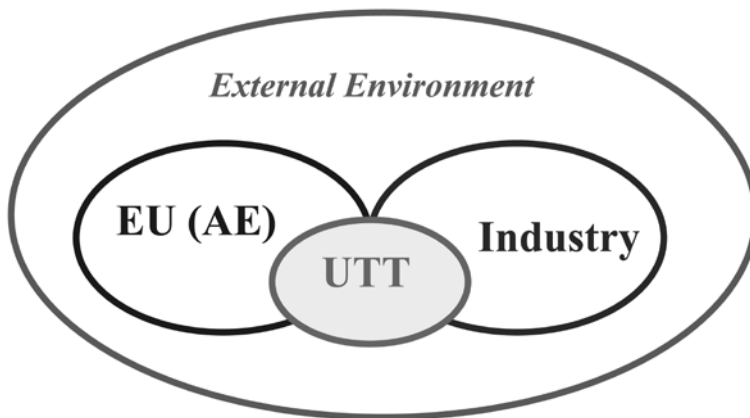


Figure 1. A Framework Depicting the Relationship between University-Level Entrepreneurship, Industry and External Environment

EU – Entrepreneurial University

AE – Academic Entrepreneurship

UTT – University Technology Transfer

Source: This study and published in Yusof, M. and Jain, K.K. (2010) Categories of University-Level Entrepreneurship: A Literature Survey, *The International Entrepreneurship and Management Journal*, 6 (1), 81-96.

Several gaps were identified in the literature which included the paucity of research on the influence of internal factors on academic entrepreneurship in university organizations, the unavailability of a uniformed scale to measure academic entrepreneurship at the organizational level of the university, the paucity of research using corporate entrepreneurship as the theoretical lens, the lack of empirical research to explain the phenomenon in the context of Malaysian public research universities, a gap in the understanding of entrepreneurial leadership in the context of research universities and its relationship with academic entrepreneurship and the paucity of research that considered the elements of the internal environment comprising of structure, control systems, human resource management systems and culture in a single study.

Building upon Ireland et. al.'s (2006a; 2006b) Corporate Entrepreneurship Climate Instrument CECI model, which theorized that corporate entrepreneurship is stimulated and supported by factors within the internal environment of the organization, the organizational framework of academic entrepreneurship depicted in Figure 2 was developed as the research framework for this study and proposed that the level of academic entrepreneurship, as the dependent variable and measured as an organization-level construct, would be strongly influenced by the identified organizational antecedents. These antecedents became the independent variables of the research framework.

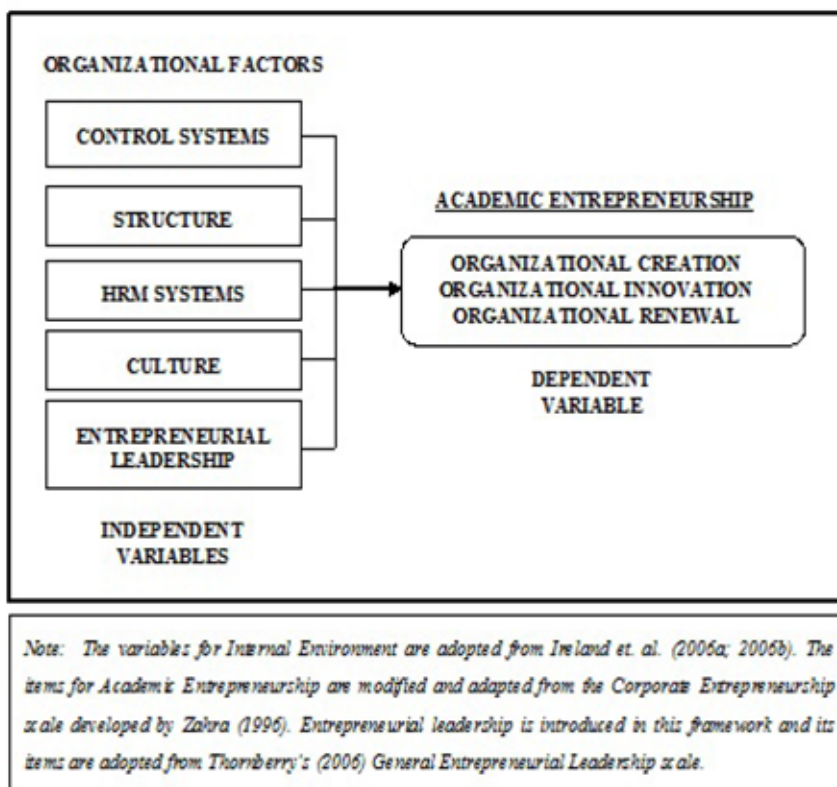


Figure 2. Research Framework

In addition, the research framework proposed that developing academic entrepreneurship in an existing university which has been governed in a bureaucratic manner into an administrative system that facilitates entrepreneurship would require entrepreneurial leadership among academic leaders with skills capable of overcoming various hierarchical and internal constraints, and conflicts. Further, the main challenge in nurturing academic entrepreneurship is to have the ability to build an entrepreneurial mindset which pervades the entire university organization. Thus, the

study proposed that entrepreneurial leadership behavior should be made an explicit factor in the framework because academic leaders need to create an organizational context that encourages the exhibition of an entrepreneurial mindset and behavior by and among individuals.

The study took the process approach in defining academic entrepreneurship and articulated academic entrepreneurship as organizational processes that results in research and technology commercialization. In this light, research and technology commercialization was regarded as the end outcome of academic entrepreneurship rather than it being academic entrepreneurship itself. Further, these processes involved organizational actions in the form of organizational creation, renewal and innovation. This view broadened the scope of academic entrepreneurship because previous studies tended to equate and limit academic entrepreneurship to just new venture creation.

Research methodology

The methodology involved the collection and analysis of quantitative data and the implementation of this design were guided by the research framework. This study referred to Brennan et. al.'s (2005) and Brennan and McGowan's (2006) framework that conceptualized the domain of academic entrepreneurship by identifying contributory streams of research, relating these categories to corporate entrepreneurship and used to investigate the enablers and barriers to entrepreneurship taking place in a university setting. This study extended the categorization of academic entrepreneurship based on the dimensions of corporate entrepreneurship by adopting and modifying Zahra's (1996) measure for corporate entrepreneurship.

It was postulated that academic entrepreneurship encompasses internal or external corporate venturing, innovation and strategic renewal performed inside or outside the university. Academic entrepreneurship may occur at the level of individuals or groups of individuals, acting independently or as part of a university system, who create new organizations, or instigate renewal or innovation within the university or outside the university via science and technology parks, university-owned corporate firms or research centers (Chrisman et. al., 1995; Röpke, 1998; Sharma and Chrisman, 1999; Brennan and McGowan, 2006). Table 1 describes the dimensions of academic entrepreneurship.

Table 1. Dimensions of Academic Entrepreneurship

Academic Entrepreneurship	Description	Source
Organizational creation	Venture creation by expanding operations in existing or new markets through university start-ups, companies, spin-offs or spin-outs and strategic alliances, joint ventures or collaboration with the industry	Chrisman et. al., 1995 Zahra, 1996 Sharma & Chrisman, 1999 Etzkowitz, 2003 O'Shea et. al., 2004 Powers & McDougall, 2005 Brennan & McGowan, 2006
Organizational innovation	The university's commitment to pursue research and development in creating and introducing scientific breakthrough, new inventions and products; introducing new ways of doing things in terms of production processes and organizational systems within the university; and, transferring and commercializing new knowledge and technology for economic and social development	Chrisman et. al., 1995 Zahra, 1996 Sharma & Chrisman, 1999 Etzkowitz & Klofsten, 2005 Röpke, 1998 Brennan et. al., 2005 Kirby, 2006 Morris, Kuratko & Covin, 2008
Organizational renewal	The transformation of the existing academic organizations through the renewal or reshaping of the ideas in which they are built; by building or acquiring new capabilities and then creatively leveraging them to add value for stakeholders; and, through revitalizing the organization's operations by changing the scope of its business, its competitive approach or both	Zahra, 1996 Sharma & Chrisman, 1999 Etzkowitz, 2003 Meyer et. al., 2002 Brennan et. al., 2005 Brennan & McGowan, 2006 Kirby, 2006 Morris, Kuratko & Covin, 2008

The internal work environment can profoundly influence the propensity of innovative behavior in academic entrepreneurs. However, this aspect was not given enough attention in past studies on academic entrepreneurship (Brennan and McGowan, 2006). Further, university organizational designs had been identified as key construct of interest in some studies (Etzkowitz, 2003; Etzkowitz and Klofsten, 2005). Organizational or work climate can be defined by an array of elements including the extent of autonomy/control, degree of structure, nature of rewards, consideration, warmth and support (Victor and Cullen, 1988) and there is no single type of work climate (Schneider, 1975).

Ireland et. al.'s corporate entrepreneurship model (2006a; 2006b) identified structure, controls, human resource management systems and culture as crucial when it comes to facilitating or inhibiting entrepreneurship in organizations. This study adopted this particular model to examine the relationship between internal factors and academic entrepreneurship. Table 2 describes the dimensions of the internal environment.

Table 2. Dimensions of the Internal Environment

Internal Factors	Description
1. Organizational Structure	<ul style="list-style-type: none"> • Horizontal over vertical • Few layers • Broader spans of control • Decentralization • Cross-functional processes • Less formalization • Open communication flow • Sense of smallness
2. Control systems	<ul style="list-style-type: none"> • Control based on 'no surprises' • Loose-tight control properties • Resource slack • Internal venture capital pools • Emphasis on self-control • Empowerment and discretion • Mutual trust • Open information sharing
3. Human resource management systems	<ul style="list-style-type: none"> • Jobs that are broad in scope • Multiple career paths • Extensive job socialization • Individual and group awards • High employee involvement in appraisals • Longer-term reward emphasis • Appraisal and reward criteria include innovativeness and risk-taking
4. Culture	<ul style="list-style-type: none"> • Entrepreneurial learning • Balanced individual-collective emphasis • Emphasis on excellence • Emotional commitment • Freedom to grow and to fail • Emphasis on results over process • Celebration of innovation • Healthy dissatisfaction and a sense of urgency • Focus on the future

Source: Ireland, Kuratko and Morris (2006a; 2006b).

These organizational factors can be barriers to entrepreneurship development in universities due to the inherent nature of education institutions being large organizations and the lack of enterprise tradition within them (Kirby, 2006). It is not the education institutions themselves which are inimical to entrepreneurship but traditional structures, bureaucracy, values and practices. Nevertheless, bureaucratic structures, practices and systems can be molded into a way that enables and arguably stimulates entrepreneurial practices (Sadler, 2001).

This study argued that academic leaders in the university need to behave entrepreneurially in order to stimulate academic entrepreneurship. Hence, it was proposed that the entrepreneurial behavior of academicians enables academic

entrepreneurship in the university. Entrepreneurial leadership can be described as visionary leadership with inherent focus on opportunities, building/creating, creative destruction/rearrangement, dynamic stake, staged investment, medium term and has an exit strategy (Thornberry, 2006).

There are various leadership theories and instruments that measure leadership behavior. Since the focus of this study was to investigate the level of entrepreneurial behavior in academicians and its association to academic entrepreneurship, Thornberry's (2006) instrument on General Entrepreneurial Leadership behavior was adopted. It was posited that in general, entrepreneurial academic leaders exhibit the following behaviors:-

- Encourage the bending/circumvention of university rules when they get in the way of achieving strategic goals and initiatives,
- Get things done even if it means going around the system,
- Willingly move ahead with a promising new approach when others might hold back,
- Promote an environment where risk-taking is encouraged,
- Encourage others to outwit and outmaneuver the university's bureaucracy,
- Quickly utilize different approaches to overcoming obstacles when the initial one does not work,
- Demonstrate an entrepreneurial orientation at work,
- Actively fight the encroachment of bureaucracy in the university, and,
- Willingly listen to suggestions from others about how to do things differently.

Kuratko and Hornsby (1998) advocated the concept of entrepreneurial leadership as being a critical factor for 21st century organizations. Using corporate entrepreneurship as the focal theory, they espoused the critical relationship an interaction between individuals' behaviors and the organization's internal environment. This relationship and critical interaction are affected by entrepreneurial leadership. Entrepreneurial leaders are supposed to recognize these elements and relationship in enacting entrepreneurship within organizations. These elements include developing the vision of innovation, the development of innovation itself, developing venture teams and structuring an entrepreneurial climate.

Sampling Strategy

The targeted population frame comprised of academic staff categorized as professors, associate professors, senior lecturers and lecturers. The Directory of Academic Profiles established by the Ministry of Higher Education, Malaysia, was used as the source for the sampling frame. The study obtained statistical, quantitative results from a stratified sample of 312 academicians from the four public research universities. Table 3 demonstrates the distribution of the respondents with respect to their academic designations and divides them into respective universities and stratum.

Table 3. Sample Distribution by Universities and Stratums

University	Professors	Assoc. Prof.	S. Lecturers	Lecturers	Total
UM	11	24	21	25	81
USM	5	15	22	29	71
UKM	8	14	24	33	79
UPM	16	19	18	28	81
Total	40	72	85	115	312

It could be said that senior lecturers were seemingly more willing to answer the survey as compared to the other stratum of respondents. The data collected from the Senior Lecturer stratum far exceeded the desired sample. The key reason for this was because many of the potential respondents identified from the Directory of Academic Profiles (the directory used to sample the population) under the category of Lecturer in 2006-2007 had completed their Ph.D.s and at the time of the survey were already designated as Senior Lecturers. Due to this also, collection of data from the Lecturer category became less successful because the directory was not current and updated at the time of the survey. It was fortunate that data from Professors and Associate Professors were able to be collected and the amount of data collected from these stratums was sufficient for further analysis. Based on the percentage of data collected against the desired size, it could be said that Associate Professors were more willing to answer the survey as compared to Professors. Overall, the final response rate of the survey was 85.9%.

Data Collection Method

A survey method was chosen to collect data and a common questionnaire was administered to all respondents in the four public research universities. This study utilized a combination of self-administered survey and computer-assisted survey. A self-administered survey is a data collection technique in which the respondent reads the survey questions and records his or her own answers without the presence of a trained interviewer (Hair et. al., 2000; Hair et. al., 2009). The direct mail survey was chosen for this approach. The questionnaire was mailed to a randomly sampled list of people from the Directory of Academic Profiles who answered the questions and returned the completed surveys by mail.

Since the respondents were academicians, it was assumed that they were capable of understanding the questions without the help of interviewers or facilitators; therefore, the direct mail self-administered survey was considered a prudent and suitable method. To produce a high response rate, in addition to mailed surveys, the randomly selected list of people was sent an electronic survey via an electronic-mail where they were encouraged to answer the survey questions linked to a website. Once the respondents completed the survey, they submitted via online and the data was captured in a repository.

The production of the questionnaire involved designing and pilot testing. The design of the questionnaire involved both the adoption and modification of existing instruments that had been developed by Ireland et. al. (2006b), Thornberry (2006) and Zahra (1996). The questionnaire was divided into two sections namely Section A and Section B. Section A consisted of questions which capture the demographic profile of the respondents. It comprised nine questions which captured the respondents' background such as gender, age, race, working status, academic qualification and academic designation.

Section B consisted of three parts which captured the organizational factors and academic entrepreneurship. Table 4 shows the variables, survey items and related hypotheses.

Table 4. Variables, Survey Items and Related Hypotheses

Variable Name	Survey Items	Related Hypothesis
Independent variable #1: Control systems	Section A, Part I: Questions 1 to 9 (measure extent of controls)	H1
Independent variable #2: Organizational structure	Section A, Part I: Questions 10 to 18 (measure extent of organizational structure)	H2
Independent variable #3: Human resource management systems	Section A, Part I: Questions 19 to 27 (measure extent of human resource management systems)	H3
Independent variable #4: Organizational culture	Section A, Part I: Questions 28 to 36 (measure extent of culture)	H4
Independent variable #5: Entrepreneurial leadership behavior	Section A, Part II: Questions 1 to 9 (measure degree of entrepreneurial leadership behavior)	H5
Dependent variable: Academic entrepreneurship	Section A, Part III: Questions 1 to 21 (measure degree of academic entrepreneurship)	H1; H2; H3; H4; H5

Part I, Section B of the questionnaire adopted the items that measure specific organizational variables in Ireland et. al.'s (2006b) Corporate Entrepreneurship Climate Instrument (CECI) which was an adaptation from Hornsby et. al.'s (2002) measurement scale. Part II, Section A of the questionnaire specifically measured entrepreneurial leadership behavior in academic organizations. The items in Section II were adopted from Thornberry's (2006) Entrepreneurial Leadership Questionnaire (ELQ). The Entrepreneurial Leadership Questionnaire maps five dimensions of entrepreneurial leadership. This study adopted the dimension of general entrepreneurial leader behavior only. Further, the scale was modified from a 5-point rating scale that rates importance and frequency to a 5-point Likert scale that measures the degree of entrepreneurial leadership behavior.

Part III, Section A of the questionnaire measures the level of academic entrepreneurship in university organizations. The respondents were asked of their perception on the extent their universities had undertaken such entrepreneurial

activities over the past three years. Section III mapped three dimensions of academic entrepreneurship which are organizational innovation, organizational creation and organizational renewal. This study modified Zahra's (1996) measure of Corporate Entrepreneurship and revised the items to make it relevant and suitable to the context of university setting.

Section I to III of the questionnaire consisted of items which were described in the form of statements that required the response in the form of Likert scales ranging from 1 to 5. This was to ensure consistency in using measurement scale. A score of 1 indicates 'Strongly Disagree', a score of 2 means 'Disagree', a score of 3 means 'Neutral', a 4 refers to 'Agree' while a score of 5 indicates 'Strongly Agree'.

A set of the preliminary questionnaire was pilot tested during the period of August 2007 in order to establish that the variables fit into the framework, thereby, establishing validity and reliability. It was first pre-tested and reviewed on the basis of grammar, syntax, spelling, integration and comprehensibility by a professor in the Faculty of Business Administration, Universiti Tun Abdul Razak and a second review was made by a senior lecturer who taught the Research Methodology course at Universiti Malaya.

The questionnaire was distributed at an international conference in Subang Jaya, Selangor and an exhibition which showcased inventions by Malaysian universities held in Kuala Lumpur. Later, it was also emailed to several academicians of two universities in Selangor. In the end, a total of 37 usable responses from academicians and researchers of several universities were collected. Table 5 demonstrates the internal reliability of the scales used in the survey instrument. The results of the reliability analysis for the variables measured through the survey instrument used in the pilot test formed the basis of a revised version which became the final questionnaire.

Table 5. Internal Reliability Score of the Scales Based on the Pilot Test

Variable	Reliability
Control Systems	0.639
Organizational Structure	0.472
Human Resource Management Systems	0.830
Organizational Culture	0.768
Entrepreneurial Leadership Behavior	0.861
Academic Entrepreneurship	0.952
Organizational Creation	0.910
Organizational Innovation	0.949
Organizational Renewal	0.764

Data analysis and key findings

Demographic Profile of the Respondents

The demographic profile of the respondents in this study consisted of gender, age, race, working status, highest academic qualification and current academic designation.

Respondents were asked to provide their background information by answering multiple-choice questions that were designed in the form of nominal scale and recoded into nominal values. A summary of the respondents' demographic characteristics is reported in Table 6.

Table 6. Demographic Characteristics and Frequency Distributions of Sample

Demographic	Frequency (N=312)	Valid Percent (%)
Gender		
Male	173	55.4
Female	139	44.6
Age		
39 or below	147	47.1
40 to 44	69	22.1
45 to 49	40	12.9
50 or above	56	17.9
Race		
Malay	261	83.7
Chinese	28	8.9
Indian	14	4.5
Other	9	2.9
Working Status		
Permanent	264	84.6
Contract	38	12.2
Other	10	3.2
Highest Academic Qualification		
PhD	204	65.4
Master	101	32.4
Other	7	2.2
Academic Designation		
Professor	40	12.8
Associate Professor	72	23.1
Senior Lecturer	85	27.2
Lecturer	115	36.9

Descriptive Analysis of Measurement Scales

In this section, the descriptive results of the measurement scale for each of the variables of the study are presented. Detailed descriptions of the items or questions, means, standard deviations, skewness and kurtosis are reported in table form. In a quantitative study, to test research hypotheses, normality testing is important, as violation of this assumption could invalidate statistical hypothesis testing. The normality of variables can be tested by skewness and kurtosis (Hair et. al., 2000; Hair et. al., 2009).

With skewness and kurtosis values of less than 1.65 in all of the measurement items for all variables and dimensions, it can be considered that generally, the measurement items were normally distributed and any further treatments of the data,

such as log-transformation, were not required. The descriptive analysis in the ensuing sub-sections is mainly based on the mean scores of each of the variables and items.

Control Systems

The scale of control systems consisted of 9 items reflecting the perception of academicians of their university's control on the budget and expense claims for research and development, the level of discretion in undertaking work, efficiency versus effectiveness in resource allocation and whether people talk openly about improving operations. Four of the items (CT1, CT2, CT3 and CT8) were reverse-coded. The results of the descriptive analysis for control systems are shown in Table 7. Respondents were asked to provide answers for each item, measured by a five-point Likert scale ranging from '1' (*strongly disagree*) to '5' (*strongly agree*).

From the mean scores, it seems, academicians in these four public research universities agreed that financial support for innovative projects were readily available and accessible ($M=3.91$, $SD=0.79$), claims for expenses in doing R&D did not go through strict control process ($M=3.72$, $SD=1.07$), budgetary controls were perceived not to be tight ($M=3.59$, $SD=1.00$) and authority was allocated to each faculty, school or department ($M=3.55$, $SD=0.87$). In addition, they fairly agreed that they had a lot of discretion in how they did their jobs ($M=3.44$, $SD=0.99$) and felt trusted by the management when it came to using organizational resources ($M=3.47$, $SD=0.97$). Further, they were slightly uncertain about the revision that could be done after budgets for R&D are accepted ($M=3.17$, $SD=0.99$) as well as to the effectiveness of these universities in avoiding waste ($M=3.02$, $SD=0.95$).

The results of the mean scores for the control systems scale seem to indicate that academicians in these four public universities perceived their organization's control systems to be flexible, convenient and accommodative of their work and responsibilities. The results also demonstrate that academicians felt trusted and were given sufficient discretionary control. In favor of academic entrepreneurship, academicians perceived that there were available and accessible funding for innovative and R&D projects. Nevertheless, it can be argued also that prudence and more effective control measures need to be put in place to promote innovation and academic entrepreneurship.

Table 7. Measures of Control Systems

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	In our university, ...				
CT1	... budgetary controls are tight.*	3.59	1.00	-0.63	-0.18
CT2	... claims for expenses in doing R&D go through strict control process.*	3.72	1.07	-0.83	0.03
CT3	... once budgets for R&D are accepted, they are difficult to revise.*	3.17	0.99	0.12	-0.93
CT4	... academicians have a lot of discretion in how they do their jobs.	3.44	0.99	-0.54	-0.24
CT5	... academicians feel trusted by the management when it comes to using organizational resources.	3.47	0.97	-0.63	-0.27
CT6	... the lines of command clearly allocate authority to each faculty/school or department.	3.55	0.87	-0.92	0.39
CT7	... there are several options for individuals to get financial support for innovative projects.	3.91	0.79	-0.95	1.39
CT8	... we are effective in avoiding waste.*	3.02	0.95	-0.02	-0.72
CT9	... the environment encourages people to talk openly with others about ways to improve operations.	3.18	1.02	-0.32	-0.65

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Organizational Structure

Table 8 shows the results of the descriptive statistics of organizational structure. A total of 9 items were measured by a five-point Likert scale on agreement levels, similar to control systems. 5 of the items (ST2, ST4, ST6, ST7 and ST9) were reverse-coded. This measurement scale contains the explanation of the academicians' evaluations of their universities' organizational structures and whether they are flexible thereby facilitating open communication flow, encourages entrepreneurship and experimentation of new ideas.

Based on the results of mean scores, the respondents in this study expressed agreement that there were not many levels of management in their universities ($M=3.96$, $SD=0.85$) and that they were organized in a way that encouraged them to independently manage their research projects ($M=3.71$, $SD=0.89$). Further, the academicians perceived that the organizational structure was not clearly defined ($M=3.64$, $SD=0.82$), agreed that red-tape was not a problem ($M=3.55$, $SD=1.04$) and that administrators believed in delegating decision-making responsibility ($M=3.24$, $SD=0.9$).

However, they were uncertain of the flexibility of the organizational structure ($M=3.02$, $SD=0.93$). The responses also indicated that the universities' bureaucratic structure did not take away or hinder the ability to be entrepreneurial ($M=3.45$,

SD=1.02) and did not limit the ability to experiment with new ideas (M=3.22, SD=1.01). Overall, the responses demonstrate that even though the organizational structure may not be truly accommodative of entrepreneurship within the universities, it has not hindered or impeded the ability of these universities to be entrepreneurial and innovative.

Table 8. Measures of Organizational Structure

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	In our university, ...				
ST1	... the organizational structure facilitates open communication flow.	3.28	0.97	-0.47	-0.42
ST2	... the bureaucratic structure takes away our ability to be entrepreneurial.*	3.45	1.02	-0.22	-0.67
ST3	... we are organized in a way that encourages us to independently manage our research projects.	3.71	0.89	-0.90	0.87
ST4	... there are many levels of management.*	3.96	0.85	-1.11	1.65
ST5	... the organizational structure is flexible.	3.02	0.93	-0.31	-0.37
ST6	... a rigid chain of command limits our ability to experiment with new ideas.*	3.22	1.01	-0.16	-0.73
ST7	... red-tape is a problem.*	3.55	1.04	-0.22	-0.94
ST8	... administrators believe in delegating decision-making responsibility.	3.24	0.90	-0.55	-0.23
ST9	... the organizational structure is clearly defined.*	3.64	0.82	-1.11	1.53

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Human Resource Management Systems

The human resource management systems scale was measured by 9 items that relate to issues such as incentives for innovation, reward for taking calculated risks, job definition, pursuance of multiple career paths, development of creative potential, evaluation of innovativeness in performance appraisal, concern with process versus performance, balance between individual incentives and team incentives and job promotion based on innovativeness. Similar to the two preceding scales, respondents of this study were asked to indicate their level of agreement, ranging from 1 to 5 on the prescribed issues. Prior to analysis, item HR7 was reverse-coded.

As presented in Table 9, academicians in these four public research universities tended to agree that they could not get ahead if they did not innovate (M=3.43, SD=1.00). In addition, they tended to perceive that their creative potential was developed (M=3.31, SD=1.02) and given considerable discretion in how they performed their tasks (M=3.3, SD=0.85). The respondents seemed to agree that in their universities, there was more concern with performance than with process (M=3.29, SD=0.99). Hence, in relation to this, they tended to agree that innovation

was highly incentivized ($M=3.25$, $SD=1.04$) and annual performance appraisals included an evaluation of their innovativeness ($M=3.2$, $SD=1.04$). Interestingly, there seemed to be moderate agreement that academicians could pursue multiple career paths ($M=3.16$, $SD=1.03$).

However, they felt uncertain on whether their universities rewarded academicians who take calculated risks ($M=3.04$, $SD=1.01$) and whether there was balance between incentives for individual initiative and incentives for team collaboration ($M=3.08$, $SD=0.92$). These results imply that the respondents did perceive their universities' human resource management systems to be encouraging innovation. However, risk-taking which is an important element of entrepreneurship was not seen to be adequately encouraged. As entrepreneurship is also built on teamwork, team collaboration needs to be equitably incentivized as well.

Table 9. Measures of Human Resource Management Systems

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	In our university, ...				
HR1	... incentives for innovation are high.	3.25	1.04	-0.47	-0.66
HR2	... academicians who take calculated risks are rewarded.	3.04	1.01	-0.09	-0.54
HR3	... jobs tend to be broadly defined with considerable discretion in how tasks are performed.	3.30	0.85	-0.72	0.36
HR4	... academicians can pursue multiple career paths.	3.16	1.03	-0.26	-0.76
HR5	... the creative potential of academicians is developed.	3.31	1.02	-0.63	-0.25
HR6	... annual performance appraisals include an evaluation of employee innovativeness.	3.20	1.04	-0.34	-0.55
HR7	... there is more concern with process than with performance.*	3.29	0.99	-0.20	-0.63
HR8	... there is balance between incentives for individual initiative and incentives for team collaboration.	3.08	0.92	-0.34	-0.46
HR9	... if you are not innovating on the job, you cannot get ahead.	3.43	1.00	-0.52	-0.19

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Culture

The descriptive statistics regarding the universities' culture in promoting innovation and entrepreneurship is reported in Table 10. A total of 9 items was measured by a five-point Likert scale examining agreement with various elements of culture related to idea generation, rewarding tested ideas, celebration of innovative achievements, encouraging failure, a sense of urgency on the importance of innovation, risk-taking

value, decision making on new ideas and support for experimental projects which may fail. Item CU5 was reverse-coded.

From the results of the means scores, there seemed to be an agreement that these universities celebrated innovative achievements ($M=3.54$, $SD=1.00$) and they had a sense of urgency regarding the importance of innovation ($M=3.42$, $SD=0.98$). This is in line with the characteristics of research universities. However, the respondents were slightly uncertain about whether their universities' culture encouraged failure ($M=3.27$, $SD=0.89$), whether small experimental projects would be supported even though some of them might eventually fail ($M=3.26$, $SD=0.86$), whether risk-taking was a core value ($M=3.19$, $SD=0.9$) and whether they had a culture that rewarded tested ideas ($M=3.11$, $SD=0.92$).

On the other hand, the respondents seemed to disagree that an employee with a good idea was given free time to develop that idea ($M=2.91$, $SD=1.02$) and that employees had a lot of say in how things were done ($M=2.84$, $SD=0.97$). These results tend to suggest that even though innovation was encouraged and required among the employees, values, mindsets, behaviors and mechanisms that were needed to support and cultivate entrepreneurship had yet to be inculcated and embodied in the organizations' culture.

Table 10. Measures of Organizational Culture

	Items In our university, ...	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
CU1	... an employee with a good idea is given free time to develop that idea.	2.91	1.02	-0.10	-0.81
CU2	... employees have a lot of say in how things are done.	2.84	0.97	0.03	-0.85
CU3	... ours is a culture that rewards tested ideas.	3.11	0.92	-0.30	-0.51
CU4	... we celebrate innovative achievements.	3.54	1.00	-0.48	-0.50
CU5	... we have a culture that discourages failure.*	3.27	0.89	-0.36	0.06
CU6	... there is a sense of urgency regarding the importance of innovation.	3.42	0.98	-0.50	-0.22
CU7	... risk-taking is a core value.	3.19	0.90	-0.18	-0.26
CU8	...new ideas tend to receive quick go/no go decisions from the management.	3.07	0.82	-0.07	-0.50
CU9	... small experimental projects are supported even though some of them may eventually fail.	3.26	0.86	-0.40	-0.17

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Entrepreneurial Leadership Behavior

In Table 11, the results of the descriptive analysis of the entrepreneurial leadership behavior variable are presented. A total of 9 items were adopted from Thornberry's (2006) General Entrepreneurial Leadership scale to measure the perception of entrepreneurial leadership behavior among academic leaders at various levels in the four designated public research universities. Respondents were asked to indicate their agreement with each item, measured by a five-point Likert scale.

Low to moderate mean scores seems to indicate that respondents were quite uncertain about the level of entrepreneurial leadership behavior among their universities' academic leaders. Among the items with moderate mean scores include the willingness of academic leaders to move ahead with a promising new approach when others might hold back ($M=3.3$, $SD=0.92$), the willingness of academic leaders to listen to suggestions from others about how to do things differently ($M=3.27$, $SD=1.05$), the ability to quickly utilize different approaches to overcome obstacles when the initial approach did not work ($M=3.21$, $SD=0.93$) and to get things done even if it meant going around the system ($M=3.17$, $SD=0.93$).

In addition, the items with low mean scores seem to be related to two characteristics i.e. work environment and entrepreneurial behavior, and, behavior in confronting bureaucracy. For the former, the respondents were highly uncertain on whether academic leaders promoted an environment that encouraged risk-taking ($M=3.07$, $SD=0.92$) and whether academic leaders demonstrated entrepreneurial orientation at work ($M=3.06$, $SD=0.89$). For the latter, the results seem to show that respondents were highly uncertain on whether academic leaders encouraged the bending of rules when the rules got in the way of achieving strategic initiatives ($M=3.09$, $SD=0.88$), whether academic leaders encouraged others to outwit bureaucracy ($M=2.86$, $SD=0.95$) and whether they actively fought encroachment of bureaucracy in the university ($M=2.76$, $SD=0.89$). For the last two items, the results also show higher responses of disagreement. These findings would possibly mean that entrepreneurial leadership was not a strong characteristic for academic leaders in Malaysian public research universities.

Table 11. Measures of Entrepreneurial Leadership Behaviour

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	In general, academic leaders at various levels of the university...				
LB1	... encourage the bending of rules when they get in the way of achieving strategic initiatives.	3.09	0.88	-0.17	-0.38
LB2	... get things done even if it means going around the system.	3.17	0.93	-0.41	-0.66
LB3	... willingly move ahead with a promising new approach when others might hold back.	3.30	0.92	-0.47	-0.35
LB4	...promote an environment where risk-taking is encouraged.	3.07	0.92	-0.13	-0.58
LB5	... encourage others to outwit bureaucracy.	2.86	0.95	0.08	-0.34
LB6	... quickly utilize different approaches to overcoming obstacles when the initial one does not work.	3.21	0.93	-0.41	-0.53
LB7	... demonstrate an entrepreneurial orientation at work.	3.06	0.89	-0.33	-0.58
LB8	... actively fight the encroachment of bureaucracy in the university.	2.76	0.89	-0.14	-0.50
LB9	... willingly listen to suggestions from others about how to do things differently.	3.27	1.05	-0.52	-0.46

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5)

Organizational Innovation

Table 12 shows the results of the descriptive statistics for the organizational innovation dimension of academic entrepreneurship. The measurement scale for organizational innovation, adapted from Zahra's (1996) 'Corporate Entrepreneurship' scale, contained seven items. Respondents were asked to indicate their level of agreement based on a five-point Likert scale.

Of all the items, the item with the highest mean score demonstrated that majority of the respondents agreed their universities had spent heavily on R&D (M=3.81, SD=0.9). In addition, they somewhat agreed that they had increased the amount of knowledge transfers to the industry through R&D (M=3.47, SD=0.92), had pioneered the development of breakthrough scientific research for local economic developments (M=3.46, SD=0.93), had introduced a large number of new inventions to the market (M=3.38, SD=1.05) and their universities had maintained world-class R&D facilities (M=3.34, SD=1.03). However, despite their agreement to the above 5 items, they seemed to be slightly uncertain about whether they had been successful (compared to other universities) in commercializing inventions (M=3.26, SD=0.93) and whether they had acquired more patents than other universities (M=3.23, SD=0.97).

Hence, it can be said that most of the efforts relating to innovation at these four public research universities had been focused on research and producing inventions for the industry and local development, however, there was uncertainty or that less effort and emphasis was put on the process of commercializing the research and inventions. It also seems that competition between the universities had been on the amount of research and inventions rather than the extent these research and inventions had been patented or commercialized.

Table 12. Measures of Organizational Innovation

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	Over the past three years, our university...				
E11	... has spent heavily (compared to other universities) on R&D.	3.81	0.90	-0.90	0.97
E12	... has maintained world-class R&D facilities.	3.34	1.03	-0.29	-0.61
E13	... has introduced a large number of new inventions to the market.	3.38	1.05	-0.38	-0.44
E14	... has acquired more patents than other universities.	3.23	0.97	-0.05	-0.13
E15	... has pioneered the development of breakthrough scientific research for local economic development.	3.46	0.93	-0.55	0.18
E16	... has been successful (compared to other universities) in commercializing inventions.	3.26	0.93	-0.40	0.20
E17	... has increased the amount of knowledge transfers to the industry through R&D.	3.47	0.92	-0.55	0.09

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5)

Organizational Creation

Descriptive statistics for the organizational creation dimension of academic entrepreneurship are reported in Table 13. A measurement scale comprised of 7 items adapted from Zahra's (1996) 'Corporate Entrepreneurship' scale was used. Similar to the measurement scale for organizational innovation, respondents were asked to indicate their level of agreement with each item on a five-point Likert scale.

As shown in Table 13, the mean scores of the measurement items were between 3.11 and 3.54. The majority of respondents in this study indicated their moderate agreement with the statement that their universities had received sponsorship from the industry to establish applied research centers to promote new venture creation ($M=3.54$, $SD=0.91$), had undertaken internal venture development through contract research with the industry ($M=3.53$, $SD=0.84$) and had expanded its international operations through strategic alliances ($M=3.41$, $SD=0.99$).

However, the respondents were slightly uncertain on whether their universities were more focused on improving operations as compared to being involved in commercialization activities (M=3.36, SD=0.83). Likewise, they were slightly uncertain to whether their universities had entered new industries through equity involvement in university start-up companies (M=3.14, SD=0.87) and as to whether their universities had established start-up companies through industrial linkages (M=3.11, SD=0.94).

Hence, the results seem to reveal that organizational creation in the form of new venture creation or start-up companies occurs through research centers which were supported by industry sponsorship or industry collaboration via contract research. It also seems to show that academicians in these public universities were less inclined to start or create new ventures or start-up companies on their own. It is also possible that academicians did not feel compelled or encouraged to start their own ventures or start-up companies by their universities.

Table 13. Measures of Organizational Creation

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
Over the past three years, our university...					
EC1	... has entered new industries through equity involvement in university startup companies.	3.14	0.87	-0.12	0.11
EC2	... has expanded its international operations through strategic alliances.	3.41	0.99	-0.55	-0.07
EC3	... has undertaken internal venture development through contract research with the industry.	3.53	0.84	-0.83	0.94
EC4	... has received sponsorship from the industry to establish applied research centers to promote new venture creation.	3.54	0.91	-0.56	0.15
EC5	... has facilitated the creation of entrepreneurial firms from internal research groups.	3.20	0.91	-0.35	-0.25
EC6	... has established startup companies through industrial linkages.	3.11	0.94	-0.33	-0.27
EC7	... seems to focus on improving the performance of its operation, rather than being involved in commercialization activities.*	3.36	0.83	-0.52	0.68

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Organizational Renewal

Table 14 shows the results of the descriptive analysis for organizational renewal, the third dimension of academic entrepreneurship. The measurement scale for organizational renewal was also adapted from Zahra's (1996) 'Corporate

Entrepreneurship' scale and it contained seven items. Respondents were asked to indicate their level of agreement based on a five-point Likert scale.

Of all the items, the item with the highest mean score demonstrated that majority of the respondents agreed their universities had initiated several programs to improve the productivity of faculties/schools or departments ($M=3.71$, $SD=0.82$). In addition, they somewhat agreed that their universities had reorganized operations to ensure coordination among faculties/schools and departments ($M=3.46$, $SD=0.0.87$), seemed to have expanded their mission to include economic enterprising in addition to teaching and research ($M=3.45$, $SD=0.92$), had changed the competitive approach (strategy) for each faculty/school or department ($M=3.44$, $SD=0.78$), had established technology transfer schemes to facilitate researchers in commercializing research ($M=3.43$, $SD=0.91$) and had established technology transfer offices to market faculties' inventions ($M=3.39$, $SD=0.98$). The respondents somewhat disagreed that their universities had maintained several unprofitable faculties/schools or departments because of public interests ($M=3.39$, $SD=0.88$).

Thus, it can be said that the respondents were aware of the on-going process of transformation for their public research universities but the mean scores somehow also indicate that the process of change had not reached the desired level set by the government and the university's management. Organizational renewal or transformation initiatives may take some time to bear fruits especially in the case of academic entrepreneurship which is an emerging process. Nevertheless, it was good to find, from these results, that these universities had actually geared up on the renewal process.

Table 14. Measures of Organizational Renewal

	Items	Mean	Scale Descriptions		
			SD	Skewness	Kurtosis
	Over the past three years, our university...				
ER1	... has maintained several unprofitable faculties/schools or departments because of public interests.*	3.39	0.88	-0.39	-0.00
ER2	... has changed the competitive approach (strategy) for each faculty/school or department.	3.44	0.78	-0.74	0.61
ER3	... has initiated several programs to improve the productivity of faculties/schools or departments.	3.71	0.82	-1.11	1.54
ER4	... has reorganized operations to ensure increased coordination among faculties/schools and departments.	3.46	0.87	-0.71	0.06
ER5	... has established technology transfer schemes to facilitate researchers in commercializing research.	3.43	0.91	-0.48	-0.12
ER6	... has established technology transfer offices to market faculties' inventions.	3.39	0.98	-0.47	-0.02
ER7	... seems to have expanded its mission to include economic enterprising in addition to teaching and research.	3.45	0.92	-0.60	0.05

Note: Responses to all items were on Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5); *Item was reverse-coded.

Reliability Analysis

Table 15 presents the initial reliability examination of the measurement scales. The Cronbach's alpha coefficients were calculated in SPSS 18. The academic entrepreneurship scale shows the highest alpha value at 0.95, while the control systems scale indicates the lowest alpha value at 0.68. Since the Cronbach's alpha values are shown to be 0.68 or above, the variables deployed in this study showed a high degree of internal consistency, thus, meeting the reliability assessment.

In total, 14 items were deleted from the scales of control systems (3 items), organizational structure (4 items), human resource management systems (2 items), culture (2 items) and academic entrepreneurship (3 items; 1 item from each dimension). The item deletion process was performed in order to increase the alpha value. Items were removed from the scale one at a time when the "Cronbach's Alpha if Item Deleted" column showed that overall reliability could be increased. Upon removing these items and reliability coefficient recalculated, Cronbach alpha values rose to the values shown in Table 15.

Table 15. Reliability Statistics

VARIABLES	CRONBACH ALPHA
CONTROL SYSTEMS	0.680
STRUCTURE	0.744
HUMAN RESOURCE MANAGEMENT SYSTEMS	0.835
CULTURE	0.810
ENTREPRENEURIAL LEADERSHIP BEHAVIOUR	0.881
ACAD ACADEMIC ENTREPRENEURSHIP	0.952

Simple Linear Regression (SLR) Analysis

The SLR analysis conducted to test five hypotheses found that each independent variable positively and significantly influences the level of academic entrepreneurship in the four public research universities. These findings support findings of previous studies that reiterated on the influence of the internal environment on the level of academic entrepreneurship in academic organizations (Etzkowitz, 2003; Brennan et. al., 2005; Brennan and McGowan, 2006; Llano, 2006; Bercovitz and Feldman, 2008, Clarysse, 2011).

However, the relationship between each organizational factor and academic entrepreneurship was not strong. The Adjusted R Square scores indicated in Table 16 show moderate to strong relationship between human resource management systems and organizational culture with academic entrepreneurship, moderate relationship between control systems with academic entrepreneurship, and, low relationship between organizational structure and entrepreneurial leadership behavior with academic entrepreneurship.

Table 16. Statement of Hypotheses and Adjusted R Square Scores of Simple Linear Regression Analysis

	Hypotheses	Results	Adjusted R Square
H1	Control systems which are perceived to support entrepreneurial activities are positively related to the level of academic entrepreneurship in the university	Supported***	0.329
H2	An organizational structure which is perceived to facilitate entrepreneurial development is positively related to the level of academic entrepreneurship in the university	Supported***	0.281
H3	Human resource management systems which are perceived to encourage entrepreneurial behaviors are positively related to the level of academic entrepreneurship in the university	Supported***	0.400
H4	An organizational culture which is perceived to nurture entrepreneurial behaviors is positively related to the level of academic entrepreneurship in the university	Supported***	0.420
H5	The entrepreneurial behavior of academic leaders in the university significantly influences the level of academic entrepreneurship in the university	Supported***	0.295

Note: *** $p < 0.001$

Hence, the results suggest that to increase the level of academic entrepreneurship, these public research universities need to improve and design their control systems, organizational structure, human resource management systems and organizational culture to be able to further stimulate, support, facilitate, nurture and cultivate more entrepreneurial activities among their academicians. In addition, academicians and academic leaders at every level of the university need to behave more entrepreneurially.

Multiple Linear Regression (MLR) Analysis

MLR analysis was conducted to investigate the association between the identified internal factors and level of academic entrepreneurship in public research universities in Malaysia. Tables 17 and 18 below provide the results of the MLR analysis for five internal factors. Based on the results in Tables 17 and 18, the overall MLR model with the selected five predictors has worked well in explaining the variation in the level of academic entrepreneurship in these public research universities ($F = 70.988$; $df = 5,306$; $p = 0.0001$).

From Table 18, control systems were found to exert a significant positive influence on academic entrepreneurship ($t = 4.789$; $p = 0.0001$; $b = +0.920$). Further, human resource management systems was found to exert a significant positive influence on academic entrepreneurship ($t = 4.179$; $p = 0.0001$; $b = +0.655$). In addition, organizational culture was also found to significantly and positively influence academic

entrepreneurship ($t = 3.610$; $p = 0.0001$; $b = +0.629$). As for entrepreneurial leadership behavior, it was also found to contribute significantly and positively to academic entrepreneurship ($t = 3.190$; $p = 0.002$; $b = +0.339$). However, organizational structure was found to be an insignificant predictor of academic entrepreneurship ($t = -0.569$; $p = 0.570$; $b = -0.134$).

Hence, the estimated regression equation is as follows:-

Academic Entrepreneurship = 6.331 + 0.92 Control Systems + 0.655 Human Resource Management Systems + 0.629 Organizational Culture + 0.339 Entrepreneurial Leadership Behavior

Table 17. MLR Results for Internal Factors as Predictors of Academic Entrepreneurship

Model		Sum of Squares	df	Mean Square	F	p	R Square
1	Regression	25312.686	5	5062.537	70.988	0.0001	0.537
	Residual	21822.382	306	71.315			
	Total	47135.068	311				

a Predictors: (Constant), Control Systems (CT), Human Resource Management Systems (HR), Culture (CU), Organizational Structure (ST), Entrepreneurial Leadership Behavior (LB)

b Dependent Variable: Academic Entrepreneurship

Table 18. Estimated Non-standardized and Standardized Regression Coefficients

Terms in the Equation	Non-standardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	6.331	3.143		2.014	0.045
CT	0.920	0.192	0.260	4.789	0.000
HR	0.655	0.157	0.261	4.179	0.000
CU	0.629	0.174	0.232	3.610	0.000
ST	-0.134	0.235	-0.035	-0.569	0.570
LB	0.339	0.106	0.165	3.190	0.002

A Dependent Variable: Academic Entrepreneurship

The proportion of explained variance as measured by R Square for the above regression equation is 0.537. In other words, 53.7 per cent of the variation in academic entrepreneurship was explained by control systems, human resource management systems, organizational culture and entrepreneurial leadership behavior. The beta values shown in Table 18 seem to indicate human resource management systems as the most important predictor of academic entrepreneurship (Beta = 0.261), secondly is control systems (Beta = 0.260), while organizational culture is the third key predictor (Beta = 0.232). And, the fourth important predictor of academic entrepreneurship is entrepreneurial leadership behavior (Beta = 0.165).

Discussion

Based on the findings derived from the hypotheses testing, descriptive analyses and regression analyses, the research provided evidence of the appropriateness of using the organizational framework of academic entrepreneurship to measure the influence of the internal environment in stimulating the level of academic entrepreneurship in Malaysian public research universities. As evidenced from previous studies on academic entrepreneurship, organizational factors contribute significantly in enabling and stimulating the level of academic entrepreneurship in academic organisations (Etzkowitz, 2003; Bercovitz and Feldman, 2008; Brennan et. al., 2005; Brennan and McGowan, 2006; Llano, 2006, Clarysse, 2011). The results are in line with the overall findings across several studies in the area of entrepreneurial university, academic entrepreneurship and university-industry technology transfer (Etzkowitz and Klofsten, 2005; Kirby, 2006; Rothaermel et. al., 2007).

The below model in Figure 3 is generated based on the MLR analysis. The analysis found four internal factors i.e. human resource management systems, control systems, organizational culture and entrepreneurial leadership behavior as significant predictors of the level of academic entrepreneurship in public research universities in Malaysia. It was also found that organizational structure as an insignificant predictor of academic entrepreneurship.

The results reinforced organizational culture and human resource management systems as key predictors of academic entrepreneurship. Interestingly, in the context of Malaysian public research universities, control systems emerged as a significant predictor of academic entrepreneurship in the internal environment. In addition, the study included entrepreneurial leadership behaviour as an organizational factor in the research model and proved that it was also a factor that positively and significantly influences the level of academic entrepreneurship.

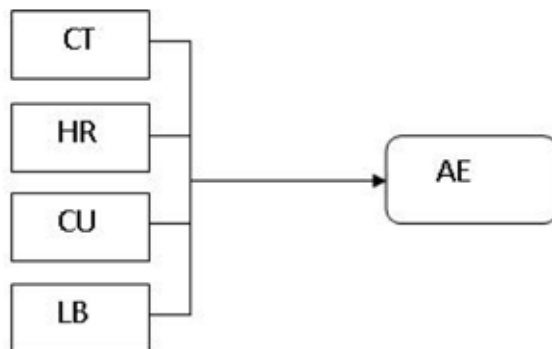


Figure 3. Organisational Model of Academic Entrepreneurship based on the Combined Effects of all Organisational Factors

There are several limitations to the research. Firstly, the context of the study was the four designated namely UM, USM, UKM and UPM. These universities were designated as research universities in 2006, at the inception of this research. During the Ninth Malaysian Plan 2006-2010 period, USM was accorded the first Accelerated Programme for Excellence (APEX) University in Malaysia. Under the Tenth Malaysian Plan 2011-2015, these four public research universities retained their status as research universities and Universiti Teknologi Malaysia (UTM) was designated as the fifth public research university in Malaysia (EPU, 2006; EPU, 2010). However, UTM was not included in this study because it was only recently that it was designated as a research university by the Malaysian Government.

Secondly, the data for the research was collected from the Directory of Academic Profiles which was established by the Ministry of Higher Education, Malaysia. The directory provided information on academicians comprising their brief personal data, areas of specialization and research contributions. This directory provided a list of potential sampling units that represented an acceptable frame of the defined target population elements which were academicians who would be involved in research activities and academic entrepreneurship. However, there was a possibility that information in the directory had not been continuously updated.

Thirdly, the current investigation was restricted to the context of public research universities; therefore, the generalisation of findings is limited by the characteristics of this specific context. These universities had been long established and were the four biggest universities in Malaysia. Therefore, they were different in terms of size, track record, policy and directions as compared to other universities. It was also viewed that they were more inclined towards academic entrepreneurship as compared to other universities which were deemed to be teaching universities. Thus, generalisations of the findings beyond public research universities such as to public teaching universities, government research institutes and private universities must be cautiously inferred.

Fourthly, the research design for this quantitative study was cross-sectional, whereby all the variables incorporated in the hypothesised model were assessed at a single point in time; hence, no definite conclusions can be drawn concerning the causality of relationships among variables. Therefore, future research via a longitudinal study would provide further significant contributions to knowledge.

Conclusion

Little has been said on the influence of the internal and organizational context of the university on academic entrepreneurship in the literature. There were some studies on the impact of one or two organizational antecedents on university technology transfer. This study brought the elements of university's internal environment comprising of structure, control systems, human resource management systems, culture and entrepreneurial leadership behavior in a single study. Previous research has either studied a specific relationship between a single organizational antecedent

and entrepreneurial activity or connected two or more of them together with entrepreneurial activity.

The study provided compelling evidence of the appropriateness of using the organizational framework of academic entrepreneurship to measure the influence of the internal environment in stimulating the level of academic entrepreneurship in Malaysian public research universities. It has contributed in developing a theory and organizational model of academic entrepreneurship. As a result, we know more about what kind of entrepreneurship is likely under various structures, control systems, human resource management systems, organizational culture and entrepreneurial leadership behavior. Further, this study's organisational framework of academic entrepreneurship has extended the study on the integrative view based on corporate entrepreneurship perspective where academic entrepreneurship encompasses organizational creation, innovation and strategic renewal which occurs inside and outside the university.

References

- Bercovitz, J., & Feldman, M. (2008). Academic entrepreneurs: Organizational change at the individual level. *Organization Science*, 19(1), 69-89.
- Brennan, M.C., Wall, A.P., & McGowan, P. (2005). Academic entrepreneurship: Assessing preferences in nascent entrepreneurs. *Journal of Small Business and Enterprise Development*, 12(3), 307-322.
- Brennan, M.C., & McGowan, P. (2006). Academic entrepreneurship: An exploratory case study. *International Journal of Entrepreneurial Behaviour and Research*, 12(3), 144-164.
- Busenitz, L.W., West, III, G.P., Shepherd, D., Nelson, T., Chandler, G.N., & Zacharakis, A. (2003). Entrepreneurship research in emergence: Past trends and future directions. *Journal of Management*, 29(3), 285-308.
- Bygrave, W.D. (1989). The entrepreneurship paradigm: A philosophical look at its research methodologies. *Entrepreneurship Theory and Practice*, 14(1), 7-26.
- Chrisman, J.J., Hynes, T., & Fraser, S. (1995). Faculty entrepreneurship and economic development: The case of the University of Calgary. *Journal Business Venturing*, 10(4), 267-281.
- Clarysse, B., Tartari, V., & Salter, A. (2011). The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship. *Research Policy*, available online 29 June 2011.
- EPU 2006. Ninth Malaysian Plan 2006–2010. Putrajaya: The Economic Planning Unit, Prime Minister's Department.
- EPU 2010. Tenth Malaysian Plan 2011–2015. Putrajaya: The Economic Planning Unit, Prime Minister's Department.
- Etzkowitz, H. (2003). Research groups as 'quasi-firms': The invention of the entrepreneurial university. *Research Policy*, 32, 109-121.
- Etzkowitz, H., & Klofsten, M. (2005). The innovating region: Toward a theory of knowledge-based regional development. *R & D Management*, 35(3), 243-255.

- Gregoire, D.A., Noel, M.X., Dery, R., & Bechard, J. (2006). Is there conceptual convergence in entrepreneurship research? A co-citation analysis of *Frontiers of Entrepreneurship Research, 1981-2004*. *Entrepreneurship Theory and Practice*, 30(3), 333-373.
- Hair, J.F., Jr., Bush, R.P., & Ortinau, D.J. (2000). *Marketing research: A practical approach for the new millennium*. Boston: Irwin McGraw-Hill.
- Hair, J.F., Jr., Bush, R.P., & Ortinau, D.J. (2009). *Marketing research: In a digital information environment*. Boston: McGraw-Hill Irwin.
- Hornsby, J.S., Kuratko, D.F., & Zahra, S.A. (2002). Middle managers' perception of the internal environment for corporate entrepreneurship: Assessing a measurement scale, *Journal of Business Venturing*, 17(3), 253-273.
- Ireland, R.D., Kuratko, D.F., & Morris, M.H. (2006a). A health audit for corporate entrepreneurship: Innovation at all levels, part I. *Journal of Business Strategy*, 27(1), 10-17.
- Ireland, R.D., Kuratko, D.F., & Morris, M.H. (2006b). A health audit for corporate entrepreneurship: Innovation at all levels, part II. *Journal of Business Strategy*, 27(2), 21-30.
- Kirby, D.A. (2006). Creating entrepreneurial universities in the UK: Applying entrepreneurship theory to practice. *Journal of Technology Transfer*, 31(5), 599-603.
- Kuratko, D.F., & Hornsby, J.S. (1998). Corporate entrepreneurial leadership for the 21st century. *Journal of Leadership and Organizational Studies*, 5(2), 27-39.
- Llano, J.A. (2006). The university environment and academic entrepreneurship: A behavioral model for measuring environment success. Technology Transfer Society Conference, Georgia Tech, Atlanta, USA, September 27-29.
- Meyer, G.D., Neck, H.M., & Meeks, M.D. (2002). The entrepreneurship-strategic management interface. In M.A. Hitt, R.D. Ireland, S.M. Camp & D.L. Sexton (Eds), *Strategic entrepreneurship: Creating a new mindset* (pp. 19-38). Blackwell Publishers Ltd.
- Morris, M.H., Kuratko, D.F., & Covin, J.G. (2008). *Corporate entrepreneurship and innovation* (2nd edition). Thomson South-Western.
- O'Shea, R.P., Allen, T.J., O'Gorman, C., & Roche, F. (2004). Universities technology transfer: A review of academic entrepreneurship literature. *Irish Journal of Management*, 25(2), 11-29.
- Powers, J.B., & McDougall, P.P. (2005). Universities start-up formation and technology licensing with firms that go public: A resource-based view of academic entrepreneurship. *Journal of Business Venturing*, 20(3), 291-311.
- Sadler, R. (2001). A framework for the emergence of entrepreneurship and innovation in education, Conference paper for the Centre for the Economics of Education and Training. Retrieved June 20, 2007 from <http://www.education.monash.edu.au/centres/ceet/docs/conferencepapers/2001confpapersadler.pdf>

- Schildt, H.A., Zahra, S.A., & Silanpaa, A. (2006). Scholarly communities in entrepreneurship research: A co-citation analysis. *Entrepreneurship Theory and Practice*, 30(3), 399-415.
- Schneider, B. (1975). Organizational climate: An essay. *Personnel Psychology* 28, 447-479.
- Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25, 217-226.
- Stevenson, H.H., & Jarillo, J.C. (1990). A paradigm of entrepreneurship: Entrepreneurial management. *Strategic Management Journal*, 11, 17-27.
- Röpke, J. (1998). The entrepreneurial university, innovation, academic knowledge creation and regional development in a globalized economy. Working paper Department of Economics, Philipps-Universität Marburg, Germany, 15. Retrieved February 25 February, 2007 from <http://www.wiwi.uni-marburg.de/Lehrstuehle/VWL/Witheo3/documents/entreuni.pdf>.
- Rothaermel, F.T., Agung, S.D., & Jiang, L. (2007). University entrepreneurship: A taxonomy of the literature. *Industrial and Corporate Change*, 16(4), 691-791.
- Sharma, P., & Chrisman, J.J. (1999). Towards a reconciliation of the definitional issues in the field of corporate entrepreneurship. *Entrepreneurship Theory and Practice*, 23(3), 11-27.
- Thornberry, N. (2006). *Lead like an Entrepreneur*, New York: McGraw-Hill.
- Victor, B., & Cullen, J.B. (1988). The organizational bases of ethical work climates. *Administrative Science Quarterly*, 33, 101-125.
- Wood, M.S. (2011). A process model of academic entrepreneurship. *Business Horizons*, 54(2), 153-161.
- Yusof, M., Siddiq, M.S., & Mohd Nor, L. (2009). An integrated model of a university's entrepreneurial ecosystem. *Journal of Asia Entrepreneurship and Sustainability*, 5(1), 57-77.
- Yusof, M., Mohd Nor, L., & Siddiq, M.S. (2010). Organizational antecedents of academic entrepreneurship in Malaysian public research universities. *Asia Pacific Journal of Innovation and Entrepreneurship*, 4(3), 43-68.
- Yusof, M., & Jain, K.K. (2010). Categories of university-level entrepreneurship: A literature survey, *The International Entrepreneurship and Management Journal*, 6 (1), 81-96.
- Zahra, S.A. (1996). Governance, ownership and corporate entrepreneurship: The moderating impact of industry technological opportunities. *Academy of Management Journal*, 39(6), 1713-1735.

Abstract (in Polish)

Artykuł koncentruje się na przedsiębiorczości akademickiej w publicznych uniwersytetach Malezji. Zgodnie z dotychczasowymi badaniami, przedsiębiorczość akademicka ma pozytywny wpływ na komercjalizację badań i transfer technologii w malezyjskich publicznych uniwersytetach. Wskazuje się ponadto na rolę przedsiębiorczej aktywności jako łącznika między badaniami naukowymi i ich

rynkową komercjalizacją. Na podstawie badań własnych, Autorzy artykułu stwierdzili wpływ wewnętrznych czynników organizacyjnych na poziom rozwoju przedsiębiorczości akademickiej w badanych uniwersytetach. Wykazano, że systemy kontroli, kultura organizacyjna, zarządzanie zasobami ludzkimi i przywództwo były kluczowymi predyktorami przedsiębiorczej aktywności w analizowanych uczelniach.

Słowa kluczowe: przedsiębiorczość, intraprzsiębiorczość, przedsiębiorczość akademicka, środowisko wewnętrzne, uniwersytety publiczne.

Declining Innovation Performance of the Hungarian Economy: Special Focus on Organizational Innovation

The Example of the European Community Innovation Survey (CIS)*

Makó Csaba , Illéssy Miklós*** , Csizmadia Péter******

Abstract

In this paper the authors intend to examine the innovation performance of the Hungarian firms before and following the period of the global financial crisis and economic downturn. Contrary to the mainstream approach non-technological innovation, more precisely workplace innovation is put into the focus of the analysis. The authors argue that this is a neglected dimension of firms' innovation activities which may become an important source of competitiveness at company level and thus it deserves more attention. The analysis of empirical data of the various waves of the European Community Innovation Survey (CIS) on non-technological innovation shows that the innovation performance of the Hungarian firms is declining. The authors complement this statistical analysis with the results of the European Working Conditions Survey demonstrating that there are significant differences in the innovation performance of such country groups as the EU-27, the Nordic and the Post-Socialist countries. Beside the country-specific comparison, the authors evaluate the performance of the Hungarian and Slovakian knowledge-intensive business service sector identified as a driver playing a "benchmark" role in speeding up workplace innovations. Finally, some key lessons are drawn indicating the need for a map on the distribution of different work organization forms in order to better understand the companies' innovation activity and skill requirements.

Keywords: workplace innovation, knowledge-intensive business sector, Hungary, Slovakia

Introduction

In the last decade, innovation has become not only one of the most generally used "buzzword" or a "new hype" of policy makers in the developed countries, but there

* Supported by the "Organisational-institutional Innovation, Industrial Clusters, as Sources of Competitiveness" - TÁMOP 4.B-10/1 Project (2011-2013) – Debrecen University – Ph.D. School of Faculty of Economics and Business Administration and Institute of Sociology – Centre for Social Sciences – Hungarian Academy of Sciences – Budapest.

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is a growing consent in the business and academic community that technological and non-technological innovations have a crucial role in a country's sustainable competitiveness and in creating new paths for economic development. The mainstream accounts of innovation deal predominantly with technological (product or process) innovation, neglecting the role and impacts of organisational innovation or socio-cultural changes as well as the social, cultural, psychological acceptance of new working practices and adaptation to them. This oversight is not just a feature of the Hungarian but also the European research and practice on innovation.

According to the European Competitiveness Report, the productivity growth advantage of the US over Europe is not just the consequence of higher standards of technological innovation. US companies are also at the forefront in terms of new organisational and management methods and governance. New business models, innovative supply methods, etc. play a key role in the introduction of technological innovations to new markets and in supporting entrepreneurship. Innovations referred to as non-technological (social-institutional) represent the "missing link" that hinders European companies in their exploitation of opportunities offered by new technologies and European integration. In this relation it is worth noting the decisive role of the workplace that is strongly influenced by the existing managerial and organisational practices. However, "The bottleneck in improving innovation capabilities of European firms might not lie in the low levels of R&D expenditure, which are strongly determined by industry structures and therefore difficult to change, but the widespread existence of working environments that unable to provide fertile environment for innovation." (Arundel et. al. 2006, cited by Alasoini, 2011b: 13).

Within the European countries we may identify visible differences in the distribution of such organisational forms or models that facilitate or constrain innovation or learning capabilities of firms. According to the 2005 data from the European Working Conditions Survey (EWCS), in comparison to the EU average, the Post-Socialist countries where work organisations with the greatest innovation and learning potential can be found are Estonia and Hungary. These two countries outperform other Post-Socialist member states. Unfortunately, however, Taylorism/Fordism – the work organisation of mass production which has the lowest learning and innovation capability – also has a strong presence in these countries. The Hungarian economy, therefore, is characterised by a dual (asymmetric) model of work organisation: front-runner companies (even measured by international standards) and companies with very restricted innovation and learning potential co-exist. Putting into the context of the EU-27 countries, the following six contrasting country profiles can be distinguished globally, according to the dominant model of work organisation^[1]:

1 Valeyre, et. al. 2009:23.

- The Scandinavian countries of Denmark and Sweden, as well as the Netherlands: the discretionary learning forms of work organisation having high innovation capabilities predominate.
- The Anglo-Saxon countries (Ireland and the UK), some Eastern European countries (Estonia, Latvia, Poland and Slovenia), Finland, Luxemburg and Malta: characterised by a relatively high development of lean production work organisation forms. The discretionary learning forms are also slightly overrepresented in Finland, Luxemburg and Malta.
- Portugal and Romania: overrepresentation of lean production and Taylorist work organisation forms.
- Bulgaria and Slovakia: the Taylorist forms of work organisation are rather widely diffused.
- Certain Mediterranean countries (Cyprus, Greece and Spain) and some Eastern European countries (Czech Republic and Lithuania): an overrepresentation of the Taylorist and traditional or simple structure forms of work organisation.
- Most Continental countries (Austria, Belgium, France and Germany): a less contrasting distribution of the different forms of work organisation and a slight overrepresentation of the discretionary learning forms. A midpoint situation is also observed in Hungary and Italy.

This model is aligned with the findings of other research results demonstrating that foreign companies and firms with mixed ownership are at the forefront of both technological and non-technological innovation. These firms emerge like cathedrals in the Hungarian economy. At the same time, fully Hungarian owned enterprises (primarily micro, small and medium-sized) pursue innovation activities of significantly less intensity (Dallago, 2010; Szerb, 2010; Chikán, Czakó, Kazainé, 2006). Table 1. highlights the relation between firms' ownership and innovation performance.

Table 1. Ownership and Innovation Activity of Firms in the Hungarian Economy: 1999 – 2005*

Ownership structure	Share of innovative firms			
	Innovative firms		Non-innovative firms	
	1991-2001**	2004-2005***	1991-2001**	2004-2005***
100% Hungarian ownership	13.4%	17.3%	84.9%	82.7%
Mixed- ownership	31.5%	30.5%	65.8%	69.5%
100% foreign ownership	17.6%	30.1%	78.5%	69.9%

*Technological "product" and "process" (TPP) innovation

**Iwasaki, I. (2004), 111. o.

*** Calculation of Szunyogh Zsuzsa (Central Statistical Office, - KSH).

Source: (Makó, Illéssy, Csizmadia, 2008. p. 1076).

Unfortunately, a great majority of the Hungarian innovation research focuses on the diffusion of the technological product and process (TPP) innovations in the manufacturing sector. We already argued that non-technological innovations also

play a very important factor in a country's competitiveness. In addition, from the turn of the century, we assist a historical shift from the manufacturing to the service economy in the developed countries of Europe, Asia and America. This shift is well reflected by the share of the economic sectors in the structure of employment. Therefore there is a growing need to address the importance of non-technological innovation: "Information and communication technologies (ICT) sometimes presented as a phenomena that can completely replace human competence and interaction, through expert systems and internet connection. The belief in this myth has proven costly for firms and public authorities. All systematic empirical and historical research shows that an acceleration in the diffusion of a radically new technology results in more harm than benefits if it is not combined with new institutions, new modes of organization and new human competence." (Lundvall, 2002:5).

The structure of the paper is organised as follows: the first section gives a brief overview of the organisational surveys carried out mainly on an international level that are useful for cross-country comparisons. The second section focuses on the theoretical foundation (OSLO Manuals) and measuring tools of non-technological innovations used in the various waves of the employer-oriented Community Innovation Survey (CIS) and presents Hungarian results on the diffusion of organisational innovation. This will be complemented with the experiences of the employee-focused European Working Condition Survey (EWCS). The final section discusses some critics of the concept of innovation adopted by the CIS and raises some issues for future research of social and organisational innovations.

Benchmarking Exercise of the Organisational Surveys: European and National Perspective

Although organisational innovation is quite a new phenomenon in the statistical data collection on a European level, the first systematic analysis of the organisational surveys was elaborated by Benjamin Coriat^[2]. Coriat distinguishes three groups of organisational surveys:

- 1) Seeking for some forms of division of labour and task coordination identified as representative forms of innovative working arrangements (e.g. teamwork, just-in-time, quality circles, etc.). This is typical of German questionnaires.
- 2) Seeking for organisational traits reflecting that the firm surveyed is innovative, i.e. it is capable of dynamically adjusting to the demands of the changing environment (intra-organisational and inter-organisational co-ordination methods). This is the case in Danish questionnaires.
- 3) A mixture of the two former groups (British and French cases).

The interpretation of data gathered by organisational surveys is a core issue. In relation to the methodology and the indicators used, Coriat raises four main problems:

2 Coriat, B. (2001). During the literature review, we used an earlier version of this paper available at http://www.lem.sssup.it/Dynacom/files/D04_0.pdf.

- 1) The questions are mostly too general and thus the answers are too vague. How to interpret and compare, for example, the introduction of teamwork in a Swedish and in a Japanese working environment? "In the same way, it is also impossible to have any idea about the nature and contents of the learning processes that take place within working teams, since they largely vary according to how those teams are coordinated, about the levels of the tasks and responsibilities those teams are entrusted with, and about the way they are inter-related and their relationships with their hierarchies." (ib. id. p. 3.)
- 2) The mere existence of some organisational forms or practices does not permit to conclude that it works in an innovative way.
- 3) This leads us to the problem of defining organisational innovation and organisational change. The majority of the surveys detect only the latter without saying anything on the innovative characteristics, if any, of these organisational changes. "Indeed, the existence of such a process within a firm clearly testifies to changing organizational patterns, but nothing can be asserted as to the nature and orientation of those changes, or the new organizational patterns or traits themselves." (ib. id. p. 4.)
- 4) Level of novelty: in the surveys it is only possible to measure already well-known and codified working practices but it is impossible to measure the radically new ones, unidentified by literature. This calls attention to the importance of such qualitative research methods as, for example, company case studies.

As it can be seen, different surveys work with different (although) implicit notions of organisational innovation. Is it possible to give one sole and explicit definition of organisational innovation? According to Coriat, it is difficult to define organisational innovation because of its "multidimensional character" and thus it can only be identified as a "joint group of attributes". This relates to the abovementioned categorisation of surveys aimed to measure organisational innovation: patterns of division of labour, specificity of coordination or a combination of these two. As Coriat puts it: "...if we consider that organizational innovation consists of a cluster of changes affecting the labour division and coordination patterns that prevail within a given organization (or between several organizations), these very patterns possessing a triple dimension (information, knowledge and know-how, interests)³, we then understand what each one of the implicit concepts of organizational innovation captures, and the difficulty to interpret the result of the confrontation of the information delivered by each one." (ib. id. p.6.)

According to Coriat, organisational surveys inform us on the presence or absence of these working arrangements and thus on the potential of any organisational innovation but the real content of these changes remain hidden. The analysis of different questionnaires does not give a definitive answer to the question of the difference between organisational change and organisational innovation. British

3 Coriat refers here to the seminal work of March and Simon (1993) in which the authors defined the notion of co-ordination as managing and processing information, knowledge and (conflicting) interests.

surveys are agnostic as for the direction of organisational change and consequently any organisational change is considered as innovation. In contrast, Danish surveys implicitly suppose that organisational change can only be innovative if it leads to more flexibility (defined as “the dynamic capacity to adjust to changing environments”, ib. id. p. 3.).

More recently, Ramioul and Huys made an inventory of the most significant organisational surveys of European countries, where the following selection principles were identified (Ramioul & Huys, 2007: 6):

- 1) possibility to measure a wide range of topics covered by the organisational changes (e.g. innovation, working and employment conditions, labour relations, etc.);
- 2) scope: the organisational survey must cover a wide range of sectors, preferably the structure of the whole economy;
- 3) periodicity: the organisational surveys must be carried out in several waves over years applying the same or similar questions.

In the framework of a recent international project aimed to collect and interpret information on the process of organisational changes in the last two decades, twenty organisational surveys were carried out covering the selection principles presented above. These organisational surveys were carried out both on international and national level, and were characterised by a variety of methodological designs. In this respect the following four significant methodological orientations should be distinguished (Meadow, 2010: 10):

- 1) Employer-focused survey,
- 2) Employee-focused survey,
- 3) Employer /employees survey (employer is sampled first - linked survey),
- 4) Employee/employer survey (employee is sampled first).

Table 2 summarises these surveys by their methodological orientation and time dimension:

Table 2. A Set of Possible Survey Designs (Meadow, 2010: 48)

Methodological orientation of the survey	Time dimension	Example of existing surveys
Employer only	Cross section*	CIS (Community Innovation Survey), ECS (European Company Survey), ESWT (Establishment Survey on Working Time and Work-Life Balance), EMS (European Manufacturing Survey).
	Panel option**	DISKO (Danish Innovation System: Comparative analysis), OSA Er (Labour demand panel – Arbeidsvraagpanel – The Netherlands), NUTEK (Technological and Organisational Change and Labour Demand (Sweden), PASO (Panel Survey of Organisations (Flanders)

Methodological orientation of the survey	Time dimension	Example of existing surveys
Employee only	Cross section	EWCS (European Working Conditions Survey), ESS (European Social Survey), BSS (British Skills Survey)
	Panel option	NWCS (Netherlands Working Conditions Survey, OSA Ee (OSA Labour supply panel – Arbeidsaanbodpanel),
Linked employer/ employee (or employer first approach)	Cross section	COI (Changements Organisationels et Informatisation, France), ESES (European Union Structure of Earnings Survey), MOA (The MOA method for assessment of Organisation – Sweden), TNO/WIS (TNO Work in the Information Society survey – the Netherlands),
	Panel option	LIAB (Institute für Arbeits- und Berufsforschung – IAB-Germany), RESPONSE (Relations professionnelles et negotiations d'entreprise-France), WES (Workplace and Employee Survey – Canada), WERS (Workplace Employment Relations Survey – UK)***
Linked employee/ employer (or employer first approach)	Cross section	AES-CVTS (Adult Education Survey – Continuing Vocational Training Survey – France), EFE (Enquete famille employeurs – France), NOS (National Organization Study – USA).
	Panel option	-

*Cross section survey: measuring change by retrospective questions.

** Panel survey: measuring change through repeated measurements.

*** The methodology of the first Hungarian Employment Survey (2010) adopted the approach of the British WERS (Workplace Employment Relation Survey), carried out in the following waves: 1980, 1984, 1990, 1998 and 2004. (See in detail: <http://www.wers2004.info/index.php>). The highlighted surveys are cross-national, NOS and WES are national (North America), PASO is regional (Flemish region) and the other surveys are national (European countries).

Table 3 classifies the seven European organisational surveys from the total twenty one (international & national) according to their acronym, name, last wave of survey and producer / sponsor.

Table 3. Main Characteristics of the European Organisation Surveys (Meadow, 2010: 91-92)

Acronym	Name of the survey	Last wave	Countries covered	Producer/sponsor
CIS (employer)	Community Innovation Survey	CIS- 2010	EU-27, Iceland, Norway and Turkey	Eurostat
ECS (employer)	European Company Survey	2009	EU-27 + Croatia, Turkey and Former Yugoslav Republic of Macedonia (FYROM)	European Foundation for the Improvement of Living and Working Conditions (EFLWC)

Acronym	Name of the survey	Last wave	Countries covered	Producer/sponsor
EMS (employer)	European Manufacturing Survey	2006	Germany, Austria, Croatia, France, UK, Italy, Slovenia, Turkey, Greece, Netherlands and Spain.	Coordinator: Fraunhofer Institute of Systems and Innovation Research (ISI)
ESES (linked employer/employee)	European Union Structure of Earnings Survey	2006	EU-27 + Iceland and Norway	Eurostat
ESS (persons over 15 years old in private households)	European Social Survey	2006 /2007	32 countries, including 22 EU countries	Coordinator: City University, UK., University Leuven, Belgium, NSD, Norway, ZUMA Germany, ESADE, Spain, Netherlands Sponsored by the European Commission and the European Science Foundation
ESWT (employer)	Establishment Survey on Working Time and Work-Life Balance	2010	EU-15 and Czech Republic, Cyprus, Hungary, Latvia, Poland, Slovenia	European Foundation for the Improvement of Living and Working Conditions (EFILWC)
EWCS (employee)	European Working Conditions Survey	2010	EU-27 + Croatia, Turkey, Switzerland and Norway	European Foundation for the Improvement of Living and Working Conditions (EFILWC)

Comparing the design and structure of the surveys presented in Table 3. above, we may distinguish two forms of co-ordination. In the first case, the survey is designed and implemented centrally (e.g. the European Working Conditions Surveys). In the second case, the survey is carried out in a decentralised way. For example, the 2004 decree of the European Commission (1450/2004/EC) is an obligatory regulation for member states to carry out the Community Innovation Survey. Eurostat is responsible for the co-ordination of surveys in close co-operation with the National Statistical Offices that are responsible for the national design, fieldwork and data analysis in every four or two (light surveys) years.

The next section presents the brief history of the European innovation statistics with a special focus on the elaboration of questions aimed to measure various dimensions of organisational innovation. Besides mapping organisational innovation related questions of the CIS, this section will give a brief overview on the importance of organisational innovations of the Hungarian firms participating in several waves of the survey. Due to the fact that the CIS is an employer-oriented survey, we use

empirical experiences from an employee-oriented survey. For this purpose, results of the various waves of the European Working Conditions Surveys (EWCS) on the learning and innovative character of the work organisation of Hungarian firms will be presented through an international comparison.

Attempts to Measure Organisational Innovation: Case of the European Innovation Survey (CIS)

From Narrow to the Broadening Views of Innovation

Building on the innovation theory of Schumpeter (1950, 1966) and stressing his so-called Mark II. period on the importance of co-operation and collective efforts in producing innovation (in contrast to the key role of the individual entrepreneurs (Mark I. period), we may assert the outcomes of innovation research “...that a firm does not innovate in isolation but depends on extensive interaction with its environment. Various concepts have been introduced to enhance our understanding of this phenomenon, most of them including the terms “system” or the somewhat less ambitious “network” (Fagerberg, 2006: 20). In recent years, the broadening view of innovation is characterising public thinking and innovation has become one of the most extensively used “catch-words” even among policy makers. For example, the Finnish national innovation strategy elaborated half a decade ago (2008), “... is based on the idea that the focus of innovation policy should be shifted increasingly to demand and user-driven innovations and the promotion of non-technological innovations” (Alasoini, 2011a: 23-24). Besides such features of innovation as radical versus incremental, product versus process, open or disruptive, social and organisational innovation, etc., we intend to stress those theoretical concepts that question the validity of unidirectional approaches where innovation is shaped by one single group of factors (e.g. “science push” or “demand pull” views of innovation). In this perspective, not only the “locus” of innovation is changing (e.g. increasing role of clients/customers, suppliers, growing importance of environmental protection, shift from manufacturing to service sector, etc.) but the “focus” too. In this relation, we share the following statement: “... when we think about the changing focus of innovation, the issue is less one of a move away from conventional technological innovation to a much more thorough understanding of how technological and social change are both required for service innovation. This itself requires some rethinking of management practice and policy development; but such a shift in focus is required if the objectives of innovation efforts are to be focused more on meeting Grand Challenges” (Basset, Miles, Thénint, 2011: 5).

One of the most important “Grand Challenges” is the historical shift from manufacturing to the service economy. From the last decades of the 20th century, we have assisted an unprecedented growth of the service sector at the expense of the manufacturing and agricultural sectors. Some service sector scholars call this radical shift in the economic activities the “service sector revolution”. In the developed countries this sector produces 70-80% of GDP, while in the Post-Socialist countries of

Central and Eastern Europe the share of service sector ranges from 58.4% to 62.9%. It is worth mentioning that in the case of Hungary between 1992 and 2006, the productivity growth in the service sector (measured by the share of the gross value added/capital) was higher than in the manufacturing sector. In addition, the service sector played a crucial role in employment generation too. Between 1995 and 2006 every second new job (46%) was created in the service sector and, interestingly enough, more than every second new job (57%) was established in the Knowledge-Intensive Business Services (KIBS). (Makó, Csizmadia, Illéssy, Iwasaki, Szanyi, 2011.)

This radical change in the economic structure raises the methodological problem of how to measure innovation in this sector. Some groups of scholars stress the difference between innovation realised in the manufacturing and in the service sectors. On the contrary, others tend to apply methods and knowledge accumulated on innovation in the manufacturing sector to the service sector: this is the so-called assimilation view. However, the boundaries between the two sectors have been diminishing and “a newly proposed synthesis approach” (Miles, Boden, 2000) argues that studies conducted on service sector innovation are capable of broadening our understanding of innovation that is currently shaped by the traditional focus on manufacturing innovation. (Beyhan, et. al. 2009: 4). One of the most important lessons learned from this debate is that besides the discussion on how to improve statistical tools and other metrics, we have to reposition our interest to better understand the features of non-technological innovation, in spite of the fact that “this may not rely on conventional R&D, nor be manifest in new ideas that can be protected by the patent measures”. (Basset, Miles, Thénint, 2011: 9).

Adopting the broadest view of organisational innovation according to which “... the term ‘organisational innovation’ refers to the creation or adoption of an idea or behaviour new to the organisation” (Lam, 2005: 115), we intend to analyse the theoretical foundations and empirical experiences of the development of statistical methods measuring organisational innovation on a European level. For this purpose, the next section focuses on changes in the guidelines of the Oslo Manual on various forms of innovation, with special attention to the organisational ones and their measurement in the various waves of the Community Innovation Survey (CIS) from 1993 until today. As the CIS is an employer-oriented survey, we intend to complete its results with the experiences of the employee-oriented European Working Condition Survey (EWCS).

Designing Questions to Measure Organisational Innovation: The Experiences of the European Community Innovation Survey (CIS)

From the end of the Second World War until the end of the 1970’s, international surveys focused exclusively on data collection of the well-known Research and Development (R&D) activities. It required more than a decade of preparation co-ordinated by the OECD and empirical experiences learned from the pilot studies carried out mainly in the Nordic countries, before the first edition of the so-called Oslo Manual was

published in 1992. This manual became the theoretical and methodological foundation of the European Community Innovation Survey (CIS). Until now, six waves of the CIS have been prepared. Table 4. summarises the most important characteristics of these surveys.

Table 4. History of the CIS and Organisational Innovation (Arundel, 2010:1)

Survey	Survey year	Reference date ¹	Organisational innovation questions
CIS-1	1993	1990 - 1992	None
CIS-2	1997	1994 - 1996	None
CIS-3	2001	1998 - 2000	Whether the enterprise introduced a new or significantly changed: 1. Corporate strategy 2. Advanced management technique 3. Organisational structure Whether the enterprise introduced a new or significantly changed: 1. Knowledge management system 2. Change to the organisation of work 3. Change to relations with other firms
CIS-4	2005	2002 - 2004	Four types of effects of organisational innovation: 1. Reduced time to respond to customer needs 2. Improved quality of goods or services 3. Reduced costs per unit output 4. Improved employee satisfaction Identical questions as in the CIS-4.
CIS 2006	2007	2004 - 2006	New questions tested in an extended version of the CIS- 2006, a pilot survey version, utilising face-to-face interviews.
CIS 2008	2009	2006 - 2008	Identical questions as in the CIS-6.

1: Questions refer to organisational innovations introduced during this time period.

In relation to the waves of the CIS, Arundel (2010: 2) indicated that in spite of the fact that the CIS-2006 adopted the same questionnaire that was used in the CIS-4, several additional questions were tested: “who developed” organisational innovation, the type of organisational innovation (new business practices) and the “effects” of innovation (improved communication or information sharing). It is worth noting that in the case of the CIS survey the Central Statistical Office of each participating country has to prepare the so-called Quality Report for the country concerned.

The first edition of the Oslo Manual dealt mainly with the technological product and process (TPP) innovations in the manufacturing sector. These measurement tools were not designed to evaluate and map service sector innovation despite of the fast growing importance of this economic sector. The Oslo Manual (1992) served as a guideline for such large scale surveys as the CIS aimed to measure factors shaping both innovation and their impacts. The second edition of the Oslo Manual (1997) provided

guidelines for both manufacturing and service sector activities. Unfortunately, the TTP approach used in this version of the Manual could not properly measure the particular characters of the service sector. It was only the third edition of the Oslo Manual (2005) that aimed to measure not only TPP innovation but marketing and organisational innovation as well. An innovation, according to this version of the Oslo Manual "... is the implementation of a new or significantly improved product (goods or services), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations." (Oslo Manual, 2005: 46). The four types of innovations are the following (Oslo Manual, 2005: 46-51):

- 1) A *product innovation* is the introduction of goods or services that are new or significantly improved with respect to their characteristics or intended use. This includes significant improvements in technical specifications, components and materials, incorporated software, user-friendliness or other functional characteristics.
- 2) A *process innovation* is the implementation of new or significantly improved production or delivery methods. This includes significant changes in techniques, equipment and software.
- 3) A *marketing innovation* is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- 4) An *organisational innovation* is the implementation of a new organisational method in the firms' business practices, workplace organisation or external relations.

Due to the core interest of the present study, in the following section we intend to focus on the questions designed to identify the various forms of organisational innovations and their impacts. For illustrative purposes, we choose the latest wave of the CIS-10 (covering the period of 2008-2010) in which the following questions measured organisational innovation.

Q9. Organisational Innovation

An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise.

- It must be the result of strategic decisions taken by management.
- Exclude mergers or acquisitions, even if for the first time.

Q. 9.1 During the three years from 2008 to 2010, did your enterprise introduce:

	Yes	No
New business practices for organising procedures (i.e. supply chain management, business re-engineering, knowledge management, lean production, quality management, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
New methods of organising worker responsibilities and decision making (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
New methods of organising external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc.)	<input type="checkbox"/>	<input type="checkbox"/>

Q. 9.2 How important were each of the following objectives for your enterprise's organisational innovations introduced during the three years from 2008 to 2010 inclusive?

If your enterprise introduced several organisational innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Reduce time to respond to customer or supplier needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve ability to develop new products or processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve quality of your goods or services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduce costs per unit output	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve communication or information sharing within your enterprise or with other enterprises or institutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Following a historical overview of the waves of the CIS and a revision of the questions elaborated with the aim to identify both the forms and the effects of organisational innovations, some empirical data on trends will be presented related to innovation in the Hungarian economy. Table 3. indicated that the CIS survey was an employer-oriented type of survey, therefore it would be beneficial to complete the empirical experiences of the CIS with an employee-oriented type of survey. In order to do so, we will use the results of the European Working Conditions Survey (EWCS). In the next section, combining the empirical information collected from both employers and employees, we may get a more balanced view on the trends and intensity of organisational innovation of firms operating in Hungary^[4].

4 In spite of the fact that the questions were not the same, the comparison was methodologically correct as both are large-scale European cross-sector surveys measuring changes with retrospective questions.

Organisational Innovation in the Hungarian Context: Some Lessons from the CIS and the EWCS

By analysing the results of the surveys, we may identify the following international pattern in general: the intensity of innovation increases with the size of the firm. For example, a great majority of small enterprises (10-49 employees) did not implement any types of organisational and marketing innovations (see Table 5). In contrast, almost every second large firm implemented organisational and marketing innovations. The other pattern observed between the period of the CIS-6 and CIS-8 is that the share of these types of innovations has declined. The decrease of innovation activity was higher than the average especially in the category of small firms.

Table 5. Relation Between the Firm's Size and All Types of Organisational (Including Marketing) Innovation in Hungary
(Community Innovation Survey, CIS-4, CIS-6 and CIS-8)

Firm's size	CIS-4 (2002-2004)	CIS-6 (2004-2006)	CIS-8 (2006-2008)
10 - 49 employees	15%	16.5%	10.7%
50 - 249 employees	28,6%	24.9%	19.8%
250 and over	46.1%	49.0%	45.3%
Total:	18.3%	18.9%	13.3%

Note: Data based on the calculation of Zsuzsa Szunyogh, Deputy Head of Division, Central Statistical Office (KSH).

Dealing with the trends and intensity of "organisational innovation only", we may say that firms rather rarely rely on organisational development (from 4.1% to 13.1%) to improve their daily operations. The other interesting pattern is that the decreasing intensity of organisational innovation has started in the CIS-4 (2002-2004). Between the CIS-6 and the CIS-8, the already rather modest share of organisational innovation halved within the group of the small firms (8.8% vs. 4.1%) and almost halved in the category of the medium-sized firms (8.4% vs. 5.5%) surveyed.

Table 6. Relations between Organisational Innovation Only /All Firms in Hungary
(Community Innovation Survey, CIS-4, CIS-6 and CIS-8)

Firm's size	CIS-4 (2002-2004)	CIS-6 (2004-2006)	CIS-8 (2006-2008)
10 - 49 employees	8.8%	8.8%	4.1%
50 - 249 employees	13.1%	8.4%	5.5%
250 and over	11.3%	10.8%	7.4%
Total:	9.5%	8.8%	4.5%

Note: The table based on the calculation of Zsuzsanna Szunyogh, Deputy Head of Division, Central Statistical Office (KSH).

This is rather an internationally well-known pattern. Organisational changes and innovation are varying substantially by size-category of the firms. For example, according to the statistically best documented Danish company practice survey

(DISKO^[5]), organisational changes (innovation) are rather frequent in large firms: nine out of every ten firms – with more than 100 employees – have carried out organisational changes in one or both periods of the surveys. Among small firms – with less than 50 employees – almost every second (46%) did not introduce any organisational change.

It is worth noting the innovation propensity of firms using the results of the employee-oriented surveys. The results of the last three waves of the European Working Conditions Surveys (EWCS) are particularly suggestive^[6]. Among the numerous questions aimed to measure the characteristics of working practices, we intend to assess the results of the questions related to the “cognitive dimension” of jobs (i.e. learning new things at work, job rotation requiring different skills, autonomy in quality supervision) and forms of training (i.e. “formal” versus “on-the-job training”) in the EU-27 countries. This job characteristic is indicating the learning potential of the firm having direct impacts on its innovation performance. In making cross-country comparison and applying an aggregated category as the EU-27 countries, we intend to compare the results of the above mentioned dimensions of working practices according to the following country profiles reflecting the varieties of the social welfare models within the European countries ^[7]:

- 1) Nordic countries,
- 2) Continental countries,
- 3) Anglo-Saxon countries,
- 4) Mediterranean countries,
- 5) Post-Socialist countries.

Comparing the cognitive dimension of jobs in the EU-27 countries, we may say that countries belonging to the Nordic-country cluster perform visibly better than the EU average in all respects: at least 4 employees out of 5 can learn new things at work, have autonomy to assess quality and every second of them participate in tasks rotation requiring different skills. The Post-Socialist countries are on the other extreme pole of the country groups, where each cognitive dimension of the jobs has a lower value than the EU-27 average. This country group is followed by the Mediterranean countries that have a rather similar pattern of job characteristics. In addition, we have to indicate the

5 DISKO is a Danish employer-oriented organisational survey aimed to identify and assess the strengths and the weaknesses of the Danish Innovation System in an international perspective. Until now, at least four waves of the survey were carried out by the Aalborg University and the Statistics Denmark. (Information provided by Peter Nielsen, Aalborg University)

6 The first EWCS was carried out in 1990 - 1991 covering 12 EU member states that made up the European Union at that time. Our analysis focuses on the following three waves of the surveys: 2000 - 2001, 2005 and 2010. The last three surveys covered the Post-Socialist countries, too. “The survey sample is representative of persons in employment (employees and self-employed), aged 15 years and over, resident in each of the surveyed countries. ... The survey sample followed a multi-stage, stratified and clustered design with a ‘random walk’ procedure for the selection of the respondents.” (Valeyre, et. al. 2009: ix.)

7 The country groups are as follows: 1). Nordic countries: Denmark, Finland, Netherlands and Sweden, 2). Continental countries: Austria, Belgium, Germany, France and Luxemburg, 3). Anglo-Saxon countries: United Kingdom and Ireland, 4). Mediterranean countries: Cyprus, Greece, Italy, Malta, Spain, Portugal, 5). Post-Socialist countries: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia. (Valeyre, et. al. 2009: 22). The “Varieties of Capitalism” (VoC) literature represents the theoretical foundation of the country classification. In addition Sapir, A. (2005) Globalization and the Reform of European Social Models, Background Document for the Presentation at ECOFIN Informal Meeting, Manchester, 9th September, (BRUEGEL – www.bruegel.org), p. 18

declining importance of the “job rotation requiring different skills” (“multi tasking and multi-skilling) in the Post-Socialist countries in comparison not only with the Nordic countries but with the EU-27 average: less than one-third of these employees rotate jobs, as shown in Table 7. The Anglo-Saxon and the Continental countries occupy the middle position between the Nordic and the Mediterranean / Post-socialist country groups.

Table 7. The Cognitive Dimension of Jobs: EU-27 versus Nordic and Post-Socialist Country Groups (2000 – 2010)

Features of job	2000			2005			2010		
	EU-27	Nordic countries	Post-Socialist countries	EU-27	Nordic countries	Post-Socialist countries	EU-27	Nordic countries	Post-Socialist countries
Self-assessment of quality	73.4%	82.8%	63.9%	71.9%	78.7%	63.5%	72.8%	82.9%	63.5%
Learning new things at work	69.9%	84.7%	66.8%	69.9%	87.4%	67.4%	68.0%	86.3%	66.7%
Tasks rotation that require different skills	n.d.	n.d.	n.d.	33.7%	52.1%	32.8%	34.0%	54.1%	27.2%

Besides the cognitive characteristics of the jobs, *the importance and structure of training or skill/knowledge formation* indicates the learning/innovation capacity of an organisation. In this relation, again, it is worth noting the leading-edge position of the Nordic-country group: the share of employees participating in (formal) training paid by the employer is significantly higher in this country group in comparison to both the EU-27 average and the Post-Socialist countries. However, as highlighted in Table 8., following a decline in the intensity of participation in formal training in the Post-Socialist countries between 2000 and 2005 (30.6% in 2000 versus 25.4% in 2005), this country group did improve its position remarkably from 2005 to 2010 (25.4% in 2005 versus 34.8% in 2010). Another interesting pattern to note is the importance of the “*informal training*” or “*situated learning*”. This kind of training represents the same share as the formal training and its importance has increased in the last half decade. Once again, the highest share of formal and informal training – almost every second employees surveyed – was registered in the *Nordic countries*. In this relation it is necessary to note that the OJT (informal or situated learning) knowledge development practice *evolved faster in the Post-Socialist countries than in the EU-27 countries*. The share of employees paying for their training has increased in all country groups between 2005 and 2010 (no EWCS 2000 data is available on training paid by employees and on-the-job training).

Table 8. Company Training Practice: EU-27 versus Nordic and Post-Socialist Countries (2000-2010)

	2000			2005			2010		
	EU-27	Nordic countries	Post-Socialist countries	EU-27	Nordic countries	Post-Socialist countries	EU-27	Nordic countries	Post-Socialist countries
Training paid by the employer	29.3%	47.85%	30.6%	26.24%	42.9%	25.4%	33.8%	48.13%	34.8%
On-the-job training (OJT)	n.d.	n.d.	n.d.	26.3%	41.33%	28.6%	32.3%	48.13%	34.0%

The final chapter of the study focuses on the diffusion of organisational innovation and knowledge development practices comparing *Hungarian and Slovak firms operating in the so-called Knowledge-Intensive Business Service sector (KIBS)*. As shown in Table 9., in each cognitive dimension of jobs *Slovakia holds a better position than Hungary*. In relation to “self-assessment of quality” and “learning new things at work”, Slovakia performs around the average of the Post-Socialist countries. In the case of the “job rotation requiring different skills” dimension, Slovakia outperforms the country group of the Post-Socialist countries (38.2% versus 32.8% in 2005 and 33.6 % versus 27.2 % in 2010).

Table 9. Cognitive Dimension of Jobs: Post-Socialist Countries versus Hungary and Slovakia (2000 - 2010)

Features of job	2000			2005			2010		
	Post-Socialist countries	Hungary	Slovakia	Post-Socialist countries	Hungary	Slovakia	Post-Socialist countries	Hungary	Slovakia
Self-assessment of quality	63.9%	43.3%	60.6%	63.5%	48.3%	52.2%	63.5%	43.0%	60.3%
Learning new things at work	66.8%	57.9%	67.2%	67.4%	58.9%	67.1%	66.7%	63.7%	64.0%
Tasks rotation that require different skills	n.d.	n.d.	n.d.	32.8%	15.6%	38.2%	27.2%	17.5%	33.6%

In relation to company training practices, detailed in Table 10., we may say that the share of employees participating in formal training paid by the employers and especially the importance of informal training (on-the-job training - OJT) is remarkably higher in the case of Slovak firms compared to the Post-Socialist country group average and notably to Hungarian firms. Finally, *it is worth mentioning that the share of informal*

training in these two countries – particularly in Slovakia – is higher in comparison to formal training. Both in the EU-27 and the Post-Socialist countries the share of formal and informal trainings is rather balanced.

Table 10. Company Training Practice: Post-Socialist Countries versus Hungary and Slovakia (2000 – 2010)

	2000			2005			2010		
	Post-Socialist countries	Hungary	Slovakia	Post-Socialist countries	Hungary	Slovakia	Post-Socialist countries	Hungary	Slovakia
Training paid by employer	30.0%	25.2%	40.2%	25.4%	15.7%	33.9%	34.8%	27.7%	36.2%
On-the-job training (OJT)	n.d.	n.d.	n.d.	28.6%	18.6%	47.4%	34.0%	28.3%	50.5%

Finally, it is worth noting that following the international financial and economic crisis (2007-2009) the share of both formal and informal trainings in Slovakia is similar or slightly higher than in the EU-27 country group average and that the share of employees participating in informal training is higher in Slovakia than in the Nordic country group.

Further Challenges in Measuring Organisational Innovations: Some Remarks

In spite of the core importance of organisational innovation in exploiting the potentials of other types of innovation (e.g. TPP), *a generally accepted and consistent theoretical framework does not exist* in the literature of organisational innovation. Due to the underdeveloped theoretical and methodological foundations, a generally accepted definition of this type of innovation does not prevail. The concepts and views of the following theoretical schools shape the various definitions of organisational innovation (Lam, 2005:116):

- 1) Organisational design theory: this orientation focuses on the interrelation between structural forms and the willingness of an organisation to innovate.
- 2) Organisational cognition and learning: this strand of literature deals with the capacity of organisations to explore and exploit new knowledge necessary to innovate.
- 3) Organisational change and adaptation: this approach examines the firms' capacity/capability to develop adequate answers to changes in external environment and how to influence it.

Another major weakness in the general definition of innovation – and especially in the case of organisational innovation – is “... to treat innovation as if it was a well-defined, homogeneous thing that could be identified as entering the economy at a precise date – or becoming available at a precise point in time ... The fact is that the

most important innovations go through drastic changes in their lifetimes.” (Fagerberg, 2006:5). In other words, the instruments (i.e. questionnaire) designed to identify or map the various types of innovation (including organisational innovation) do not realise the “continuous” character of innovation.

In addition, Coriat (2001) stresses the following weaknesses of survey methods aimed to identify and assess organisational innovation:

- 1) The definitions (implicit or explicit) used in surveys “do not generally encompass the whole dimension” of organisational innovations.
- 2) It is important to investigate the direction of organisational innovation because the most radical organisational changes themselves may lead to reproduce the Taylorist principles of work organisations.
- 3) European companies are engaged in implementing organisational innovation that results in a “self-fuelled dynamism”. However, there remains many possibilities to foster this process partly by public policies which have been so far mainly concerned by technological innovation.
- 4) Organisational innovation always results in a better organisational performance and organisational efficiency influencing both the cost and non-cost related competitiveness of firms.
- 5) A more systematic comparison is needed between the theory of organisational innovation and the empirical results.
- 6) There is a contradiction between the obvious advantages offered by organisational innovation and the relative slowness of their diffusion. This can be explained by objective and subjective factors (i.e. the intensity of change in the environment varies by regions, sectors, etc., while the subjective dimension means the ability of firms to perceive changes and the necessity to react to them). Another factor contributing to the low rate of diffusion of organisational innovation is that the knowledge and know-how in this field is poorly codified with the exception of the most widespread organisational standards like ISO and just-in-time, to some extent. Finally, organisational innovations generally reshape the hierarchical and governance structure of firms and this often creates conflict of interest among the different levels of firms’ hierarchy.

In summary, Coriat calls attention to *the complex character of the implementation of organisational innovation*: “Organizational innovation can only fully materialize if its systemic dimension is totally recalled and taken into account. We mean that a “local” change (concerning one aspect of the division and coordination of labour), may very well lead to no positive results, but even to supplementary dysfunctions if the organization is not adapted and made coherent with the locally introduced changes.” (ib. id. p.16.)

We intend to stress the rather *problematic character of the distinction between “product” and “process” innovation in the case of the service sector innovation*. In this sector, services are used or consumed at the point of the production. The various waves of the CIS do not pay attention to the significant differences between

the manufacturing and the service sectors. (Beyhan, Dayar, Findik, Tandogan, 2009: 4). Until now, there is no consent among the representatives of the “assimilation”, “dissimilarity” or “synthesis” approaches aimed to better understand innovation in the service sector.

In spite of the experiences of several national innovation surveys (e.g. the Danish DISKO surveys) on the key role of “knowledge absorptive capacity” in an innovative organisation, until now this dimension of innovation has been left out of the existing organisational innovation surveys (including the CIS). This capacity in an organisation is not identical with the formal qualification which is the by-product of “learning as acquisition”⁸. In relation to the knowledge absorptive capacity of the organisation, instead of solely insisting on the role of formal training “... what really matters is the ability to deploy qualifications in the job situation. This makes competence an important concept, especially when it relates to the qualities of social capital as cooperation capacity and communication skills internally between different functions, and extremely towards various actors. What the learning organisation requires is a *triad of formal education, competence and social capital*” (Nielsen, 2006: 97).

References

- Alasoini, T. (2011a). Workplace Development as Part of Broad –based Innovation Policy: Exploiting and Exploring Three Types of Knowledge. *Nordic Journal of Working Life Studies*, 1, 1, 23-43.
- Alasoini, T. (2011b). Learning network as an infrastructure for the creation and dissemination of workplace innovation: an introduction. In: Alasoini, T., Lahtonen, M., Rouhiainen, N., Sweins, Ch., Hulkko-Nyman, K., Spanger, T. (eds.) *Linking Theory and Practice (Learning Networks at the Service of Workplace Innovation)*. Helsinki: TYKES Reports 75, pp. 13-30.
- Arundel, A. (2010). *Organisational Innovation in the European Community Innovation Survey (CIS)*. Maastricht: UNU-MERIT, p. 12.
- Arundel, A., Lorenz E., Lundvall B.A., Valeyre A. (2006). The organisation of work and innovative performance: a comparison of the EU-15’, paper presented at the Statistics Canada Blue Sky II Indicators Conference, Ottawa, Canada, October 2006.
- Basset, J., Miles, I., Thénint, H. (2011). *Innovation Unbound: Changing innovation locus, changing policy focus*. Versailles. France: LLA.
- Beyhan, B., Dayar, E., Findik, D., Tandogan, S. (2009). Comments and Critics on Discrepancies between Oslo Manual and the Community Innovation Survey in Developed and Developing Countries. Ankara: Sciences and Technology Policies Research Centre (TEKPOL) – Middle East Technical University, p. 11 (<http://stp.metu.edu.tr>).

8 For example, the so-called „labour process school” makes a distinction between “learning as acquisition” and “learning as participation”. “The former refers to a conceptualization, which views learning as a product with a visible, identifiable outcome, often accompanied by certification or proof of attendance. The latter perspective, on the other hand, views learning as a process in which learners improve their work performance by carrying out daily activities.” (Felstead, et al. 2008:5). This classification is similar to the distinction of “formal education” and “competence development” or “situated learning”.

- Boden, M., Miles, I. (eds.). (2000). *Services and the Knowledge-Based Economy*. London, New York: Routledge.
- Chikán, A., Czakó, E., Kazainé, Ó. A. (2006). *Gazdasági versenyképességünk vállalati nézőpontból – Versenyben a világgal, 2004–2006 (The Hungarian economic competitiveness from an enterprise point of view – Competing with the world)*. Research programme.(Final study). Budapest: Budapesti Corvinus Egyetem, Vállalatgazdaságtani Intézet Versenyképességi Kutatóközpont.
- Coriat, B. (2001). Organizational innovations in European firms: A critical overview of the survey evidence. In D. Archibugi and B-Å. Lundvall (eds.) *The Globalizing Learning Economy*, Oxford: Oxford University Press, 195–218.
- Dallago, B. (2010). SME Policy and Competitiveness in Hungary, *OPENLOC Research Project – Autonomous Province of Trento*, p. 22.
- Fagerberg, J. (2006). Innovation (A Guide to the literature), In: Fagerberg, J., Mowery, D. C., Nelson, R. R. (eds.) *The Oxford Handbook of Innovation*. Oxford: Oxford University Press, pp. 1-26.
- Felstead, A., Gallie, D., Green, F., Zhou, Y. (2008). Employee Involvement, the Quality of Training and the Learning Environment: An Individual Level Analysis (Paper submitted for publication in the *International Journal of Human Resource Management*).
- Lam, A. (2005). Organizational innovation. In: Fagerberg, J., Mowery, D. C., Nelson, R. R. (eds.) *The Oxford Handbook of Innovation*, Oxford: Oxford University Press, pp. 115-147.
- Lundvall, B-A. (2002). *The University in the Learning Economy*. Aalborg University: DRUID Working Paper No. 02-06.
- Makó, Cs., Csizmadia, P., Illéssy, M., Iwasaki, I., Szanyi, M. (2011). Organizational Innovation and Knowledge Use Practice: Cross-Country Comparison, (Hungarian versus Slovak Business Service Sector). Tokyo: *Institute of Economic Research – Hitotsubashi University. Discussion Paper Series*, B. January, 38, 214.
- Makó, Cs., Illéssy, M., Csizmadia, P. (2008). A munkahelyi innovációk és a termelési paradigmaváltás kapcsolata, (A távmunka és a mobil munka példája), *Közgazdasági Szemle*. LV. Évf. December, 1075-1093.
- March, J., Simon, A. J. (1993). Organisation Revisited. *Industrial and Corporate Change*, 2, 299-316.
- MEADOW Guidelines*, (Measuring the Dynamics of Organisation of Work). (2010) Project funded within the 6th Framework Programme of the European Commission's DG Research. Grigny (France): DOMIGRAPHIC, p. 386.
- Nielsen, P. (2006). *The Human Side of Innovation Systems*, (Innovation, New Organization Forms and Competition Building in a Learning Perspective). Aalborg: Aalborg University Press, p. 189.
- OECD Review of Innovation Policy: HUNGARY* (2008) Paris: OECD, p. 229. (www.oecd.org/publishing/corrigenda).

- OSLO Manual (The Measuring of Scientific and Technological Activities) Guidelines for Collecting and Interpreting Innovation Data* (3rd Edition) (2005) Joint Publication of OECD and Eurostat. Paris: OECD, p. 164.
- Ramioul, M., Huys, R. (2007). *Comparative Analysis of Organizational Surveys in Europe, Work Organisation and Restructuring in the Knowledge Society – EU-6th FP – WORKS-CIT3-CT-2005*. Leuven: Institute for Advanced Studies (HIVA), p. 81.
- Schumpeter, J. (1950). *The Process of Creative Destruction*, in: Schumpeter (ed.) *Capitalism, Socialism and Democracy*, 3rd ed. London: Allen and Unwin.
- Schumpeter, J. (1966). *Invention and Economics*. Cambridge, Mass.: Harvard University Press.
- Szerb, L. (2010). *Vállalkozások, vállalkozási elméletek, vállalkozások mérése és a Globális Vállalkozási és Fejlődési Index*. Budapest: *Akadémiai Doktori Disszertáció*, Szeptember, p. 226.
- Szunyogh, Zs. (2011). *Az innováció mérésének módszertani kérdései*. *Statisztikai Szemle*, 88. évf. 5. sz. pp. 492-507.
- Valeyre, A., Lorenz, E., Cartron, D., Csizmadia, P., Gollac, M., Illéssy, M., Makó, Cs. (2009). *Working Conditions in the European Union: Work Organisation*. Luxemburg: Office for Official Publications of the European Communities, p.59.

Abstract (in Polish)

Autorzy artykułu badają innowacyjność węgierskich firm przed i w trakcie globalnego kryzysu finansowego i spowolnienia gospodarczego. Skoncentrowano się na innowacjach nietechnologicznych, szczególnie innowacjach organizacyjnych (w zakresie organizacji miejsca pracy). Autorzy twierdzą, że ten niedoceniany rodzaj innowacji może stać się istotnym źródłem konkurencyjności, zarówno na poziomie gospodarki, jak i przedsiębiorstwa, a zatem wymaga głębszych badań. Z analizy danych empirycznych European Community Innovation Survey (CIS) dotyczących innowacji nietechnologicznych wynika, że innowacyjność węgierskich firm spada. Autorzy uzupełniają analizy statystyczne danymi European Working Conditions Surve, które wskazują, na znaczące różnice w innowacyjności takich grup państw, jak państwa UE-27, nordyckie i postsocjalistyczne. Obok analiz porównawczych na poziomie kraju, przeprowadzono także porównawcze badanie węgierskiego i słowackiego sektora usług biznesowych opartych na wiedzy, które traktowane są jako zarówno wzorzec, jak i źródło innowacji organizacyjnych. Sformułowano ponadto zalecenie dotyczące przyszłych badań nad organizacją miejsca pracy, w celu głębszego poznania działalności innowacyjnej przedsiębiorstw oraz ich potrzeb w zakresie rozwoju umiejętności.

Słowa kluczowe: innowacje organizacyjne, usługi biznesowe oparte na wiedzy, Węgry, Słowacja.

Regional Determinants of Efficiency Growth of Small and Medium-Sized Enterprises. Evidence from Poland

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Abstract

SMEs sector plays a vital role in modern economies. Therefore, the interest in its functioning among economists is in fact quite natural. This article is a part of a current research on regional factors contributing to the development of enterprises in this category.

The first section examines earlier studies in this field conducted globally and in Poland. According to them, many elements enable the SME's development. It is not surprisingly that the specified set of pro-growth factors does not exist.

Next section describes the results of the author's own studies in the fields. These studies relate to regional factors contributing to the efficiency growth of micro, small and medium-sized enterprises in Poland. Data used in the study was collected from GUS^[1] and EUROSTAT and encompassed 16 provinces for the years 2003-2008. The model prepared included 11 independent variables on labor force, social mobility, living standard and R&D policy. The authors would have gladly considered more than 11 explanatory variable, but the inaccessibility of such data made it impossible. In the next step, using GRETl software, equations of regression were defined. On this basis it was concluded that the most important factors contributing to efficiency growth of SMEs are the amount of spending on R&D and the level of wages.

Keywords: small and medium-sized enterprises; factors of regional development; regions in Poland, business efficiency; entrepreneurship.

Introduction

Studies of broadly understood development of small and medium-sized enterprises have a long standing tradition in the literature of the subject. At their foundation lies a special role for enterprises of this size in the creation of basic macroeconomic values, such as GDP, employment or international exchange. Against this background attention is given to connections between the SME

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sector and determinants of its development. Because of that, on the grounds of economic theory and practice factors are being sought which stimulate the development of small and medium-sized enterprises in both contexts: the economy as a whole and regionally. We must underline the mutual relationship between SMEs and region. On one side, small and medium-sized enterprises have influence on the development of the regions or countries (Valliere, Peterson, 2009), and on the other, particular regions create different conditions stimulating the development of entrepreneurship. For example according to some results, urban and rural areas differ from each other as potential environments for enterprises (Ritsilä, 1999).

Scientific studies were primarily focused on the role of SMEs in the economic development, possibilities of supporting innovation processes performed by economic entities of this category and on formulating effective economic policy on this background. Twenty years after the publishing of the famous Bolton report, C. Gray and J. Stanworth, evaluating the achievements of economics of small and medium-sized enterprises, drew attention to the change in approach to this notion. In studies on entrepreneurship, and particularly on possibilities of formulating effective policy for small and medium-sized enterprises sector, regional aspect started being considered (Gray, Stanworth, 1991). Ch. Karlsson and R. Dahlberg also emphasize that „one of the strongest, most important contexts for small business and entrepreneurship to emerge in recent years is region”. They site explanation for this phenomenon mainly in the fact that at regional level there are certain facilitation in formulation and transmission of social capital (Karlsson, Dahlberg, 2003).

A region is also important from the perspective of creation and transformation of knowledge. „While it spills over across the firms and workers of a region, such regional spillovers tend to be localized; thus accessing and participating in knowledge requires geographic proximity. Small-firm networks, clusters, and linkages are organizational structures that have emerged in an effort to take advantage of the region” (Karlsson, Dahlberg, 2003). Important from the perspective of significance of a region and development of small and medium-sized enterprises is the approach presented within the New Economic Geography trend, according to which the key significance in the studies undertaken is played by such values as: potential market, transaction costs, internal and external economies of scale and strengthening development processes in the region, which provide new impulses for entrepreneurship like the development of small and medium-sized enterprises and contribute to the creation of clusters. The studies of these values are at the same time a starting point in formulation of effective state and local government policy for development of enterprises of this size and creation of clusters.

Regional determinants of development of small and medium-sized enterprises

Results of studies conducted worldwide

A strength of a region consists of many factors, mainly connected with entrepreneurial climate, in the broad sense. In studies conducted in this field by the Rabobank in Holland, the following factors were analyzed: firm dynamics, SMEs sector dynamic, export orientation, willingness to invest instead of entrepreneurial willingness, labor productivity, investment in transport infrastructure, SMEs' R&D expenditure and knowledge. The authors also cited many interesting research results, particularly from the area of broadly understood human resources. For example, a higher level of business activity was observed in many peripheral regions than in more economically developed region of Holland. This unexpected findings may be a result of 'congestion in business' arising from high competition, tougher barriers to entry, monopolistic position on some entities and a greater difficulty to be innovative (Naudé, Gries, Wood, Meintjies 2008). It was also noted that two out of three new firms are founded by one owner. The authors' of Rabobank research devoted particular attention to three other indexes, such as: education level, labor cost and job density, which for its particularly high level in large agglomerations is described as agglomeration effect. (Pellenbarg, van Steen, 2007).

In studies on the determinants of entrepreneurship, and especially on the conditions of creation of new firms in Great Britain, a number of additional factors were chosen and studied. It was found that regional factors affect both the creation process of new firms and their survival. Very important, from a research perspective are: population growth so far, high percentage share in the population of people with high managerial and vocational skills, urban concentration, household wealth, demand.

Several interesting regularities were also indicated, such as:

- new service companies arise in the proximity of large enterprises, and new production companies are located near small business.
- funds and programs supporting small and medium-sized enterprises decrease the number of bankruptcies,
- state programs for the SMEs sector are less significant in their creation than in increasing their survival rate. (Keeble, Walker, 1994).

Further results of the research conducted by M. Hart and S. McQuinnes on the factors impacting the development of small and medium-sized enterprises in Great Britain unequivocally indicated the role of government-funding, regional financing of enterprises of this size, particularly in regard to survival and death rate. Moreover, the SMEs using the Local Enterprises Development Unit (LEDU) support grow faster than others. A positive influence of urban region on SMEs location was also noticed, due to the access to entrepreneurship incubators (Hart, McQuinness, 2003).

The literature on the subject includes three different approaches in research on the relationship between entrepreneurship growth in a region and an increase of a number of new workplaces. First of all it illustrates that pro-entrepreneurial attitudes result in creation of new enterprises, which automatically create new workplaces. Secondly, it is noted that new firms modify the level of competitiveness, forcing the existing firms to improve their to date competitive advantage. Furthermore, new enterprises are the source of innovation and consequently contribute to long-term economic growth.

Of interest, at least from a local differentiation perspective, are the results of the research from Lithuania, which point out that despite differences between particular regions in regard to population density, convergence was observed between GDP per capita and indexes characterizing SMEs. Additionally, an obvious correlation was observed between the decline of employment in agriculture and the increase of the SMEs sector. A clear differentiation between regions was also present in regard to the share of a particular region's export, import and direct investments. In conclusion, the authors emphasize that „The accomplished analysis explores an interregional contradictions increase which leads to uneven development of territories. Due to this, regional policy implemented by the state must pay attention to peculiarities of their development. It is clear enough that not separate, but a whole complex of means are necessary to enhance security of sustainability of development in Lithuanian regions. In decreasing inter-regional contradictions a special role may be played by purposeful support provided to export by the state that would help to diversity its marketable structure and extend assortment of imported ready production” (Bernatonyte, Vilke, Volochovic, 2009).

In research on the influence of regional factors on the start-up ratio conducted in Japan, the following measures were used: demand factors and costs (population growth rate, average wage in the manufacturing sector), human resources (unemployment ratio, the ratio of university graduates, ratio of employment in professional and technical occupations), financing (the ratio of householders as possibility of the start-up financing), industry agglomeration (density of establishments, proportions of manufacturing plants) and industry structure. Moreover, the researchers analyzed the average business size, the access to express stations, highway interchanges and the role of the public sector expressed as local servants to the populations. The results of conducted studies show strong positive influence of demand factors, human resources, effects of industry agglomeration, effect of average business size and traffic access on the start-up processes. A negative influence on this process was attributed to costs and householder ratio. As underlined by the authors, “These results give emphasis to the importance of the local accumulation of qualified human resources as supporting factor of start-up activities” (Okamuro, Kobayashi, 2006). This is reflected, among others, in positive correlation between the

increasing number of start-ups in regions characterized by a larger share of higher education workers and higher employment in professional and technical occupations. There is also a positive correlation between the number of new enterprises and the number of real estate owners, because housing's ownership can be a good collateral and safety net for the founders. The smallest enterprises are created the fastest (Okamuro, Kobayashi, 2006).

In their research, H. Westlund i R. Bolton assumed that entrepreneurship remains in close association with social capital; they also took into consideration the New Economic Geography approach, according to which in a region wage surplus is created beside producer and customer surplus (Westlund, Bolton, 2003). Similarly, as resulting from the study of S.Y. Lee, R. Florida and Z. Acs, special significance for creation and development of small and medium-sized enterprises should be sought for in social characteristics, and particularly in the influence of human capital and social diversity on entrepreneurship: „the results suggested, that one needs to pay attention to the social habitat of a region to boot a regional entrepreneurial dynamics” (Lee, Florida, Acs, 2004). It is being underlined that the more diverse regions try to attract more creative human capital by lowering the entry barriers, which ultimately results in business creativity.

A special type of the region – entrepreneurship relation occurs in periphery regions, less developed and unfavorable in terms of conditions for creating and running a business. Studies conducted by P. Vaessen and D. E. Keeble enabled them to formulate the following conclusions. „First, small business growth is possible under different territorial conditions, including different levels of competition and market between regions and differences in the occupational and skill structure of labor market. Secondly, many SMEs do not remain passive towards external pressures and constraints imposed by their regional environment. Instead, enterprises in peripheral regions may actively and even successfully work to develop strategies to overcome these constrains. Those firms success may acquire so much business expertise and market intelligence that they can even outstrip their counterparts in more favorable, resource-rich environments. In this way an initial location disadvantage may ultimately benefit rather than inhibit company growth and performance” (Vaessen, Keeble, 1995).

S. Venkataraman, in the study of changes in a region induced by entrepreneurship, emphasizes that in many scientific descriptions major attention is paid to tangible elements, such as: legal regulations, capital market, modern system of transport and communication (Venkataraman, 2004). These features are highlighted by the author as particularly important, as they – according to Schumpeter's approach - enable the enterprise to function in the region, and create conditions for techno-entrepreneurship development. The author also emphasizes the importance of intangible elements, particularly in the regions of developing countries, however these remarks may also be used in less developed

regions of transforming countries. „Many developing regions are characterized by cultures that celebrate and depend on tradition. The most talented people are directed into position in which they are not rewarded for making bold bets. As a result, unconventional ideas, companies, projects, and products do not emerge. People who become entrepreneurs under these circumstances do so as a last resort. They may be unemployed, underemployed or handicapped, and their efforts generally result in low-quality enterprises”. Such conditions, where venture capitals or risk capital are not interested in investing in such regions, and government programs do not additionally support this kind of entrepreneurship, consolidate a traditional structure, low business culture and ultimately low level of region’s wealth. And people with innovative ideas emigrate to developed knowledge centers with universities. In order to retain them in the region and undertake the effort of its transformation by supporting technopreneurial activity, S. Venkataraman suggests such intangibles:

- local points capable of producing novel ideas: access to institutions that produce new knowledge,
- the need for right role model,
- the need for informal forums of entrepreneurship as well as the need for region-specific ideas to be created, access to entrepreneurial education and experience,
- the need for safety nets and the culture of accepting failure,
- the need for gateway cities to large markets for their products and services,
- the needs for executive leadership.

Similar conclusions with regard to possibilities of creation of various forms of information exchange forums and local leaders were formulated by economists studying this problem in a chosen region of Greece. They underline the significance of regional information centers, discussion forums and training programs, diffusion and creation of knowledge in equalizing the opportunities of particular regions and conditions of entrepreneurship functioning (Dimitriadis, Simpson, Andronikidis, 2005).

Results of studies conducted in Poland

Literature on the subject distinguishes many relationships between the region and entrepreneurship. Measuring these relationships on a local level, six groups of determinants can be distinguished (Krajewski, Śliwa, 2004):

- morphological,
- demographic,
- economic,
- organizational,
- structural,
- relational.

Morphological determinants are connected with a size of a region, location, climate conditions, surface terrain, water and soil conditions, and demographic determinants refer to the characteristics of broadly understood human capital: population size and structure, including the division based on qualification, mobility inclination. Economic determinants – generally speaking - are related to the level of economic development; particular role of the possibility to gain external capital by small and medium-sized enterprises is underlined. Under organizational determinants we understand the quality of a functioning of local authorities; structural and relational determinants refer to the entrepreneurship area: the former describe the level of adjustment of enterprises location to the resources and market, the latter characterize the network of internal and external connections between particular participants of economic space (Krajewski, Śliwa, 2004).

K. Safin, in turn, distinguishes three groups of determinants of entrepreneurial development: personality of the small and medium-sized enterprises owner, mesoeconomic and macroeconomic conditions. Among local determinants he lists: location, society education, active attitude of local society, local authorities ability to rationally formulate plans. (Safin, 2005).

The most detailed and valuable research on relationship between characteristics of a region and entrepreneurship in Polish literature was conducted by K. Wach. Considering the results of analysis made in the Małopolska and Śląsk regions in 109 small and medium-sized enterprises and in 150 communes, the authors characterized regional frameworks, which determine the conditions of creation and development of this size of enterprises (Wach, 2007). Such 16 factors were taken into account as:

- B2B services,
- business rent prices,
- closeness to/from co-operants,
- closeness to/from sales market,
- closeness to/from suppliers,
- commercial financial support,
- image of the region,
- IT infrastructure,
- living standard of local community,
- local policy in favor of SMEs,
- public financial support,
- regional business associations,
- regional business support centers,
- regional labor resources,
- supply of business offices,
- transport and physical infrastructure.

The author, by querying entrepreneurs and local authorities, revealed certain differences in perception of pro-development factors among these two groups. According to entrepreneurs, the most important factors in this regard include IT infrastructure and the proximity of sales market and suppliers. Commune's authorities believe that most important stimuli of entrepreneurship are also sales market proximity, quality of local policy in favor of SMEs and image of the region. In an entrepreneurs opinion the least significant factor for their development are public financial support, local policy towards business and commercial financial support. In these fields local authorities express similar judgment. They are convinced that commercial financial support, public financial support and business rental rates are irrelevant for business success.

In studies of relationships between the region and entrepreneurship, K. Wach emphasized not only the factors supporting this process but also its barriers. And thus, the most important regional barriers to SMEs development include: inefficient public financial support, local policy in favor of SMEs and commercial financial. Entrepreneurs additionally believe that their development is unlikely to be blocked by supply of business offices, IT infrastructure and proximity to co-operants. As for communes authorities, the most burdensome are insufficient commercial and public financial support. Business rental rates can also be perceived as high burden. Very significant differences in perception of most important barriers by local authorities and business entities occur in regard to local policy in favor of SMEs. In communes, this barrier took the 14th place on the list, while for entrepreneurs it ranks as second most important obstacle. Other irrelevant barriers in communes opinion are regional labor resources and image of the region.

Regional determinants of development of small and medium-sized enterprises in Poland – empirical studies

The scope of research suggested by the authors of this article is slightly different than proposals of authors cited earlier. We decided to analyze the determinants of SME sector's development of efficiency, dividing nationwide data into provinces. The necessary data was collected from GUS (*Central Statistical Office* in Poland) and EUROSTAT. Data used in panel studies covered the years 2003-2008. In its initial form, the panel encompassed 16 provinces, 3 dependent variables and 11 explanatory variables. Methodology of econometrics recommends including in the initial model the widest possible set of economic variables, which helps explain the behavior of dependent variable. Further, with the use of the econometric model, an attempt was made to evaluate the significance of regional factors in the development of micro, small and medium-sized enterprises. The classical least squares method was used. While using this method, it is necessary to define a set of hypotheses, which the econometric model is to confirm or reject (Górecki, 2010). A zero hypothesis is always

formulated in such a manner, that a given explanatory variable has no influence on a response variable, and the alternative hypothesis means that this influence exists. The next stage was to define the equations of regression – a GRET software was used – which is the base for interpretation of correlations between variables. In further stages of the model improvement, the set of explanatory variables was reduced.

The dynamics of enterprises' efficiency growth in particular categories was measured with the volume of revenues generated by the enterprise of a given category per one employee in thousands PLN. The parameters, which are dependent variables in the proposed models are presented in table 1.

Table 1. Dependent variable in estimated econometric models

No.	Dependent variable	Revenues in average enterprise in Poland per employee [thousands PLN]	
		2003	2008
1	dynamics of micro-enterprises development	146,2	200,3
2	dynamics of small enterprises development	315,2	388,5
3	dynamics of medium enterprises development	285,8	412,2

Source: Bank of regional data of GUS.

Independent variables used in these studies do not cover the entire scope of regional environmental factors presented in previous sections due to data inaccessibility. Among dependent variables, the representatives of the following areas are missing: financial support, local authorities initiatives, entrepreneurship infrastructure, B2B services and communication infrastructure or socio-psychological profile of entrepreneur. The model, however, includes the variables describing labor source (active people, wages, unemployment, tertiary education, HRST, LLL), social mobility (permanent and temporary migration), local living standard (disposable income) and indirectly referring to technology (R&D expenditure). One of the factors, namely the volume of investments in enterprises, is a characteristic feature of enterprises themselves and not a category of a regional environmental type (table 2).

As a result of calculations made with the GRET software, a series of numerous parameters of formulated econometric models was achieved. The most important of these, referring to a reduced number of most significant determinants, are presented in table 3.

Table 2. Independent variables used in models

Independent variable	Short name	Unit	Average value in Poland in	
			2003	2008
Percentage of society professionally active aged 24-65	Active people	%	44,4	44.6
Average gross wage	Wages	PLN	2 315	3 158
Average monthly income at a disposal of one person	Disposable income	PLN	683	1007
Investments per employee in enterprises	Investment	thousands PLN	17,5	30.0
R&D expenditures per citizen in PLN	R&D expenditure	PLN	119	202
Unemployment rate	Unemployment	%	19.6	7.1
Percentage of people studying at levels 5-6 (ISCED 1997)	Tertiary education	%	5.2	5.7
Human Resources in Science and Technology* as a population ratio	HRST	%	16.6	21.4
Long life learning as percentage of age population from 24-65	LLL	%	4.4	4.7
Balance of permanent migration as a percentage of entire population	Permanent migration	%	0.036	0.039
Balance of temporary migration**	Temporary migration	%	from -0.76 to 0.46	from -0.51 to 0.41

* These resources are defined either by education or current profession. As for the education, HRST includes qualified citizens with at least higher education (ISCED 5-6), also unemployed and inactive, and those without higher education, but performing tasks requiring specialized or technical higher education. More information on this subject can be found, for example, in a document, Retrieved from: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Anne-xes/hrst_st_sm1_an1.pdf [21.11.2009].

** This line presents range of balances in a given year in all provinces in Poland.

Source: Bank of regional data of GUS and EUROSTAT.

All presented models are characterized by the empirical value of parameter F much higher than critical value taken from tables of F distribution, which means that the hypothesis about insignificance of equations of regression should be rejected.

Similarly, the coefficient of determination R² reaches an acceptable level in around 85% of the cases of small and medium-sized enterprises, and 68% of the micro enterprises. This indicates that in presented models, respectively 85% and 68% of variability of the response variable is described by total variability of all explanatory variables in a given model, and 15% or 32% respectively of variability of the dependent variable is unexplained.

Coefficients calculated in the first model, regarding microenterprises, assume reasonable values. Their interpretation leads to the conclusion, that revenue per one microenterprise's employee increase of 0.186 thousand PLN if the R&D expenditures per citizen are increased by 1 %. On the other hand, we will encounter a decrease in revenue per employee of 2.11 thousand PLN if the unemployment rate increases by 1%. An explanation of such result may be explained (although

the model has not indicated it) in the decrease in demand caused by the decrease in the citizens' financial resources. This explanation seems reasonable, especially when considering the fact that microenterprises usually operate in local markets. A decrease of microenterprises development dynamics (of 1.78 thousand PLN in revenue per employee) is also recorded if the percentage of professionally active citizens increases by 1%. The only explanation of such a state of affairs may be the fact that a greater number of professionally active people entails a greater number of workers, with a relatively constant turnover in the enterprises sector in this region. Revenue per one employee in microenterprises also decrease by 27.52 thousand PLN, if the balance of temporarily migration compared to the size of the entire population increases by 1%, which means that the number of citizens leaving the region will increase. The change in revenue is notable, but we should remember that the balance of temporary migration did not exceed 0.76% in any of the provinces in the given period. Therefore a change of migration balance of 1% is rather improbable.

Table 3. Parameters of econometric models

Type of enterprise	Significant explanatory variables	ratio	p-value	R2	F
Micro	R&D expenditure	0.186	<0.00001	0.683246	F (4.91) = 49.07 F005 = 2.47
	Unemployment	-2.110	<0.00001		
	Active people	-1.782	0.00042		
	Temporary migration	-27.523	0.00187		
Small	Active people	-4.013	<0.00001	0.867859	F (5.90) = 118.21 F005 = 2.32
	R&D expenditure	0.343	<0.00001		
	Wages	0.049	0.01928		
	Temporary migration	82.926	0.02243		
	HRST	6.201	0.03508		
Medium	Wages	0.243	<0.00001	0.844924	F (5.90) = 98.07 F005 = 2.32
	Temporary migration	-60.4516	0.00411		
	R&D expenditure	0.262	0.00611		
	Disposable income	-0.251	0.00949		
	Tertiary education	15.6317	0.02246		

Source: Own.

The model explaining the development dynamics of small enterprises shows several similarities to the model regarding microenterprises. Development dynamics of small business entities as in micro-entities, also depends on the research and development expenditures, percentage of professionally active citizens and temporary migration. In case of the first two factors, the direction of correlation between explanatory and dependent variables is the same, only

the sensitivity of dependent variable to the fluctuation of explanatory variable in case of small enterprises is greater than in case of microenterprises. And so, the revenue per employee in small enterprises increases by 0.343 thousand PLN, if the research and development expenditures per citizen in the region increase by 1 %. Revenue per employee of small enterprises will decrease by 4.013 thousand PLN if the percentage of professionally active people increases by 1%. It is hard to explain the fact that an increase of temporary migration balance of 1% causes an increase of revenue per employee in small enterprises by as much as 83 thousand PLN. The increase of efficiency dynamics of small enterprises is also influenced by wages and the amount of Human Resources in Science and Technology. In case of the first parameter, an increase of 1% causes an increase in revenue per employee in enterprises of this category of 49 PLN, and the increase of HRST share in population of 1% yields an increase of the development dynamics meter in small enterprises of 6.2 thousand PLN. Both these facts can easily be explained, as a wage increase in a region translates into an increase in demand, and the increase in the ratio of people connected with science and technology normally translates into an increase of margins in businesses. It is so, because usually in such condition the enterprises located in a given region tend to sell more sophisticated, innovative goods and services.

The last model describes medium-sized enterprises. Their development depends mainly on the wage level. Each time it grows by 1%, the revenues per one employee increases by 243 PLN. The direction of influence of migration on economic entities in this category is the same as recorded in the case of microenterprises. Revenue per employee decrease when the balance of people leaving the region is positive. Each 1% increase in this balance causes a decrease in revenue per employee of 60.45 thousand PLN. A positive influence on the development of medium-sized enterprises is also recorded in the case of increases of expenditures on research and development and the percentage of people acquiring higher education. An increase of R&D expenditures per citizen of 1 %, as well as the increase of a number of university students in a population of 1%, causes an increase of revenue per employee in enterprises of 0.26 and 15.63 thousand PLN respectively. In case of medium-sized enterprises it is hard to explain however, why an increase of disposable income of one citizen should cause a decrease of revenue per employee in this category of enterprises (increase in disposable income of 1% causes a decrease of revenues per employee by 251 PLN).

The presented models outline an image of factors (those, which were studied) which most significantly affect the development of SMEs sector (table 4). This group should most of all include the amount of expenditures on research and development and the wage level in a region. The influence of migration on performance of micro, small and medium-sized enterprises was inconclusive. In case of the active people factor, there are no prerequisites to question its

influence on changes of average revenue per employee. A larger number of professionally active people can in fact contribute to a decrease in value of measured dependent variable. We cannot state however, that minimizing the percentage of active people brings socio-economic benefits, which the model suggests. Other explanatory variables were significant only in individual models, therefore it was assumed that their influence on the development of the entire SMEs sector is weak.

Table 4. Most important factors influencing the efficiency development of SMEs sector

Explanatory variable	Number of models in which the variable was significant	Unambiguity and direction of influence on response variable
R&D expenditure	3	Unambiguous, increase of expenditures results in the increase of SME's development dynamics
Temporary migration	3	Ambiguous, in two cases the revenues per employee decrease along with temporary negative migration in a region; in once case a reverse relationship was found.
Active people	2 (micro, small)	Unambiguous, a decrease of revenues per employee was recorded with an increase of the percentage of professionally active people. Such relationship is controversial.
Wages	2 (small, medium)	Unambiguous, increase of wages causes slight increase of revenues per employee.
Unemployment	1 (micro)	Decrease of unemployment has positive impact on enterprises' efficiency dynamics.
Disposable income	1 (medium)	Increase of disposable incomes causes the decrease of enterprises' efficiency dynamics.
Tertiary education	1 (medium)	Increase of the number of students positively influences the rate of development of enterprises
HRST	1 (small)	Increase of Human Resources in Science and Technology causes the increase of enterprises revenues dynamics.

Source: Own.

The region, in which the expenditures on R&D (the most important SMEs' growth factor) grew the fastest is Świętokrzyskie province (table 5). An increase of 624% is impressive, however, these expenditures in 2003 were extremely low - 10 PLN per citizen (Poland's average at that time was 119 PLN). In this case we are certainly encountering a low base effect. Very good results in this regard were also achieved by Zachodniopomorskie, Pomorskie and Podlaskie provinces. A decrease in dynamics of research and development expenditures was recorded in Lubuskie province. Generally poor results were also achieved by Kujawsko-Pomorskie, Opolskie and Warmińsko-Mazurskie provinces.

Table 5. Dynamics of R&D expenditures in particular provinces in years 2003-2008

Province35	Base level [PLN per citizen]	Increase in R&D expenditure [%]
Lubuskie	33	-15.2
Kujawsko-Pomorskie	49	27.8
Opolskie	27	44.8
Warmińsko-Mazurskie	37	52.4
Podkarpackie	55	53.6
Łódzkie	106	57.2
Śląskie	80	63.9
Mazowieckie	389	64.1
Wielkopolskie	107	68.2
Małopolskie	160	70.2
Lubelskie	63	76.2
Dolnośląskie	89	78.7
Podlaskie	32	95.9
Pomorskie	90	99.3
Zachodniopomorskie	34	117.4
Świętokrzyskie	10	624.0

Source: Own preparation based on GUS data.

Considering the increase of wages (the second most important SME's development factor), first place in this summary belongs to Dolnośląskie, Pomorskie, Lubelskie and Opolskie provinces (table 6). The lowest dynamics of positive changes in the level of wages were recorded in Warmińsko-Mazurskie, Lubuskie, Podkarpackie and Mazowieckie provinces. It is worth noting, that differences in particular regions between the wage dynamics are lower than those regarding research and development expenditures.

Table 6. Wages dynamics in particular voivodeships in years 2003-2008

Province	Base level [thousands PLN]	Increase in R&D expenditure [%]
Warmińsko-Mazurskie	2.00	30.6
Lubuskie	1.99	33.3
Podkarpackie	1.95	34.1
Mazowieckie	3.01	34.3
Kujawsko-Pomorskie	2.00	34.5
Wielkopolskie	2.13	34.7
Zachodniopomorskie	2.13	35.0
Łódzkie	2.02	35.4
Świętokrzyskie	2.02	35.6
Śląskie	2.38	36.1
Podlaskie	2.04	36.6
Małopolskie	2.11	37.6
Opolskie	2.09	37.7
Lubelskie	2.00	38.9
Pomorskie	2.26	40.3
Dolnośląskie	2.23	40.4

Source: Own preparation based on GUS data.

Conclusions

Regional diversification may significantly influence the efficiency development of small and medium-sized enterprises. Research in this regard is a starting point in the formulation of the right economic policy for a country. They may also indicate which of the dependent factors and in what conditions significantly contribute to the socio-economic development. Among the research results cited in this publication, the factors that most frequently influence the development of the SME sector are: physical infrastructure, financial support, business-to-business services, regional policy in favor of SMEs, well-qualified labor resources and finally knowledge and technology transfer.

Studies conducted by the authors were aiming at identifying the important regional environmental factors in Poland. A certain limitation in formulating the econometric model for this purpose occurred in form of lack of some statistical data and unquantifiable nature of some of regional environmental factors. The task was also impeded by the requirements necessary to create a reasonable model, namely the necessity to consider relatively long term series of variable. Nevertheless, the models regarding micro, small and medium-sized enterprises were created and their reliability is satisfactory. Based on these models a conclusion was made that the factor most strongly connected with the efficiency development of enterprises in all categories is research and development expenditures. The higher those expenditures are, the more dynamically the enterprises develop. Other determinants with unequivocal and directly proportional influence on the development of SME sector are:

- wages,
- tertiary education ratio,
- number of Human Resources in Science and Technology,

An inversely proportional relation between SMEs' efficiency growth and factors conditioning it was noticed in the case of such variable:

- active people,
- unemployment,
- disposable income.

References

- Bernatonyte, D., Vilke, R., Volochovic, A. (2009). Regional Peculiarities of Development of Lithuanian SME. *Economics and Management*, 14, 676-84.
- Dimitriadis, N., Simpson, M., Andronikidis, A. (2005). Knowledge Diffusion in Localised Economies of SME's: The Role of Local Supporting Organisations. *Environment and Planning C: Government and Policy*, 23 (6), 799-814.
- Górecki, B. R. (2010). *Ekonometria – podstawy teorii i praktyki*, Warszawa: Key Text. (ang.) *Econometrics - Basic theory and practice*, Warsaw: Key Text.
- Gray, C., Stanworth, J. (1991). Bolton 20 Years on: The Small Firm in the 1990s. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship. <http://ssrn.com/abstract=1496718>.
- Hart, M., McQuinness, S. (2003). Small Firm Growth in the UK Regions 1994-1997: Towards an Explanatory Framework. *Regional Studies*, 37 (2), 109-12.
- Karlsson, Ch., Dahlberg, R. (2003). Entrepreneurship, Firm Growth and Regional Development in the New Economic Geography: Introduction. *Small Business Economics*, 21 (2), 73-6.
- Kneble, D. E., Walker, S. (1994). New Firm, Small Firms, and Dead Firms: Spatial Patterns and Determinations in the United Kingdom. *Regional Studies*, 28 (4), 411-27.
- Krajewski, K., Śliwa, J. (2004). *Lokalna przedsiębiorczość w Polsce. Uwarunkowania rozwoju*. Warszawa: Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego. (ang.) *Local entrepreneurship in Poland. Conditions for development*. Warsaw: Publishing House of Faculty of Management in University of Warsaw.
- Lee, S. Y., Florida, R., Acs, Z. (2004). Creativity and Entrepreneurship: A Regional Analysis of New Firm Formation. *Regional Studies*, 38 (8), 879-91.
- Naudé, W., Gries, T., Wood, E., Meintjies, A. (2008). Regional determinants of entrepreneurial start-ups in a developing country. *Entrepreneurship & Regional Development*, 20 (2), 111-24.
- Okamuro, H., Kobayashi, N. (2006). The Impact of Regional Factors on the Start-up Ratio in Japan. *Journal of Small Business Management*, 44, 310-13.

- Pellenberg, P. H., van Steen, P. J. M. (2007). The Regional Business Climate in the Netherlands. Spatial Variations in Entrepreneurship, Labour Productivity, Infrastructure and Knowledge. *Journal of Economic & Social Geography*, 5, 696-705.
- Ritsilä, J. J. (1999). Regional differences in environments for enterprises, *Entrepreneurship & Regional Development*, 11 (3), 187-202.
- Safin, K. (2005). Uwarunkowania rozwoju przedsiębiorczości – próba systematyzacji. In *Uwarunkowania przedsiębiorczości*, ed. K. Jaremczuk. Tarnobrzeg: Państwowa Wyższa Szkoła Zawodowa. (ang.) Conditions for development of entrepreneurship - an attempt to systematize, In *Determinants of entrepreneurship*, ed. K. Jaremczuk. Tarnobrzeg: State Higher Vocational School.
- Valliere, D., Peterson, R. (2009). Entrepreneurship and economic growth: Evidence from emerging and developed countries. *Entrepreneurship & Regional Development*, 21 (5/6), 459-80.
- Vessen, P., Keeble, D. E. (1995). Growth-Oriented in Unfavorable Regional Environments. *Regional Studies*, 29 (6), 489-505.
- Venkataraman, S. (2004). Regional Transformation Through Entrepreneurship. *Journal of Business Venturing*, 19 (1), 153-67.
- Wach, K. (2007). Regional Barriers and Stimuli of SMEs Development in Southern Poland, In *Prace Naukowe Katedry Ekonomii i Zarządzania Przedsiębiorstwem*. Vol. IV. Gdańsk: Politechnika Gdańska (ang.) Regional barriers and stimuli of SMEs development in Southern Poland, In *Scientific Papers of the Department of Economics and Business Management*. Vol. VI, 379-84. Gdańsk: Gdańsk University of Technology.
- Westlund, H., Bolton, R. (2003). Local Social Capital and Entrepreneurship. *Small Business Economics*, 21 (3), 77-113.

Abstract (in Polish)

Sektor małych i średnich przedsiębiorstw odgrywa kluczową rolę we współczesnej ekonomii. Nie dziwi zatem ciągle zainteresowanie ekonomistów uwarunkowaniami jego funkcjonowania. Ta publikacja wpisuje się w ciągle aktualny nurt analizy wpływu różnych czynników na rozwój podmiotów gospodarczych tej kategorii.

Pierwsza część publikacji prezentuje przegląd dorobku nauki światowej i polskiej w omawianym obszarze.

Z analizy literatury łatwo wywnioskować, że wiele czynników przyczynia się do rozwoju małych i średnich przedsiębiorstw. Nie dziwi również fakt, że trudno znaleźć zbiór zmiennych, który w równym stopniu, w różnych państwach i regionach oddziałuje na wzrost sektora MSP.

W kolejnej części publikacji przedstawiono wyniki badań własnych autorów. W badaniach tych podjęto próbę wyznaczenia czynników pro wzrostowych wychodząc od zmiennych wartości wybranych parametrów w poszczególnych regionach. Posłużono się danymi

publikowanymi przez GUS i EUROSTAT dotyczącymi 16 województw za lata 2003-2008. Stworzono model wykorzystujący 11 zmiennych niezależnych charakteryzujących zasoby ludzkie, mobilność społeczeństwa, standard życia i nakłady na badania i rozwój. Skorzystanie z większej ilości zmiennych uniemożliwiła ich niedostępność. Badając problematykę wykorzystano program GRETL, dzięki któremu określono równania regresji. Na tej podstawie stwierdzono, że najważniejszymi czynnikami przyczyniającymi się do rozwoju małych i średnich przedsiębiorstw jest wielkość nakładów na B+R oraz poziom wynagrodzeń. Słowa kluczowe: małe i średnie przedsiębiorstwa, czynniki rozwoju regionalnego, regiony w Polsce, efektywność przedsiębiorstwa, przedsiębiorczość.

