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THE IMPACT OF ENTREPRENEUR EDUCATIONAL ATTAINMENT AND PROFESSIONAL EXPERIENCE ON THE INNOVATION ACTIVITY OF SMEs: THE CASE OF THE WIELKOPOLSKA REGION

Abstract: The article attempts to assess the impact of entrepreneurs' education and professional experience on the innovation activity of the companies they run. Its authors relied on the findings of their own survey, dating back to 2014, covering 54 SMEs based in the Polish region of Wielkopolska. The study concentrated on various aspects of the companies' innovation as pursued in 2011–2013.

The authors assumed that SME innovation is a function of entrepreneur competencies, which in turn depend on their formal educational attainment, experience acquired while working in the overall R&D sector and the extent to which they benefited from advisory services offered by business-support institutions.

In the course of their research, the authors fully proved the hypothesis concerning entrepreneurs' formal education and partially supported the remaining ones (with respect to some of the innovation criteria adopted for the study). They established a direct link between professional experience in the R&D sector and the use of advisory services on the one hand and the originality of product innovations on the other. A similar relationship has been discovered between the training of business proprietors and the number of process innovations generated by their organizations.

Keywords: entrepreneur competence, innovation, small and medium-sized companies, traditional industries.

JEL codes: I25, L26, O30, O38.

Introduction

According to the Central Statistical Office the innovation activity in Poland's small and medium-sized companies remains low and has hardly improved over the last dozen or more years [Mizgajska 2013, p. 15]. The 2014 Innovation Union Scoreboard report [European Commission 2014] gave Poland a very poor ranking, ahead only of the least innovative countries, i.e. Romania, Latvia and Bulgaria. The report listed the strengths and weaknesses of each of the EU's 27 member states broken down by innovation drivers. The strengths which drive innovation in the Polish economy include the quality of human resources and innovation expenditures unrelated to R&D. These findings underline the importance of the quality of human resources for national innovation activity. It would be interesting in this context to check whether this factor is equally significant on the micro-scale.

The purpose of the ongoing study was to identify the extent to which business innovation activity is influenced by entrepreneurs' formal educational attainment, their professional experience acquired in research institutes and R&D units of industrial plants, the training they have completed and the advisory services they received from organizations operating in business-support institutions. The focal point of the study were small and medium-sized companies operating in the traditional industries of the Wielkopolska Region. The study timeframe was 2011–2013.

Based on the literature and their own practical experience the authors put forward the hypotheses that:

- H1: The formal education of entrepreneurs is directly proportional to the level of innovation activity seen in their enterprises.
- H2: Entrepreneurs' professional experience acquired in research institutions or R&D units of industrial organizations is directly proportional to the level of innovation activity seen in their enterprises.
- H3: The extent of entrepreneur training is directly proportional to the level of innovation activity seen in their enterprises.
- H4: The advisory services received by entrepreneurs are directly proportional to the level of innovation activity seen in their enterprises.

The choice of the Wielkopolska Region for study purposes was quite deliberate. Wielkopolska ranks amongst the leading regions in terms of entrepreneurship activity [Mizgajska 2013, p. 35]. In assessing the aggregate regional entrepreneurship activity, account is taken not only of business innovation but also of entrepreneurship indexes and innovation activity [Mizgajska 2013, p. 25]. Wielkopolska is one of the regions whose innovation activity is low and inconsistent with its other economic performance indicators. For instance, its industrial sector innovation activity in 2010–2012 [Central Statistical Office 2012] placed it in the second but last position amongst Poland's regions in a ranking topped by the Podlaskie Region. Meanwhile Wielkopolska was third in the national statistics on newly-registered businesses per 1000 population in 2010, outperformed only by the Regions of Mazowsze and Western Pomerania. Clearly innovation ratings have little bearing on the economic growth of individual regions which can be misleading.

One reason suspected for Wielkopolska's low innovation activity is the fact that its industrial sector remains heavy weighted on middle – and low-technology industries such as food, woodworking and furniture. Another possible reason is that Wielkopolska companies tend to purchase cutting-edge manufacturing machinery and equipment. Having successively upgraded their machinery for an extended period production companies of Wielkopolska, a region known for its thriving enterprise, have reached a point where they can afford to reduce their innovation activity to a relatively low level.

The authors have employed empirical evidence by surveying 54 micro-, small- and medium-sized Wielkopolska-based companies. These organizations stemmed from such traditional and relatively uninnovative industries such as food, furniture, printing, glass, metalworking, plastics and boiler manufacturing. The empirical material was gathered through personal interviews held with entrepreneurs. The companies were surveyed by third-year undergraduate students of the Poznań University of Economics as part of their Business Entrepreneurship and Innovation class. The students targeted companies which had been in operation for more than three years. The interviews were held in 2014 in the Wielkopolska Region. The information regarding completed innovations and the concerned companies came from the 2011–2013 period. The outcomes were processed with the help of descriptive statistics, Kendall tau rank correlation coefficients and the chi square test.

1. The research problem in literature

Researchers investigating the impact of education and experience of small and medium-sized business proprietors and managers on their enterprises' innovation activity commonly refer to the theories of entrepreneurship and resources. In the theory of entrepreneurship, entrepreneurs are the central actors responsible for assessing the technological potential of their enterprises and coordinating technological processes. They apply their people management skills within their companies and employ knowledge derived from various external sources. The theory relies on describing entrepreneurs as pivotal in their companies [Amit, Glosten, and Muller 1993]. According to Rizzoni [1991], entrepreneurs' behaviour and their approach to innovation depend on their age, education and prior experience.

Other research refers to resource theory. The resource-based approach presents the enterprise as a collection of unique, difficult-to-replace, scarce resources which provide one with a lasting competitive advantage. The resources can be either tangible or intangible, such as managerial knowledge. According to Autio, Yli-Renko, and Sapienza [1997] and Meeus, Oerlemans, and Hage [1999], any enterprise's most valuable resource is its highly skilled employees. Meeus, Oerlemans and Hage [1999] assessed the quality of in-house resources based on the proportion of workers with higher education. They examined the impact of the competencies of the staff of small business on their innovation. Teece [2007], on the other hand, stressed that only enterprises capable of promptly adjusting their internal and external competencies in a rapidly changing environment succeed in managing and deploying innovation. A vital strategic role in this process is played by highly knowledgeable managers who can make all the right decisions such as are needed to employ new technologies.

In Polish literature education – seen as an integral part of human capital – has attracted a great deal of interest. As such education featured heavily in writings on innovation activity drivers in Poland, Poland's regions and individual industries [Firszt 2008; Tokarz 2010]. Relatively less has been written about the influence of human capital characteristics on innovation in small and medium-sized enterprises. One crucial piece of research in the field came from Szczepaniec and Jurkiewicz [2009] who, in 2007 and again in 2009, surveyed 1308 micro, small and medium-sized companies representing all sectors of the economy and all of Poland's 16 regions. The authors attempted to find out whether human capital (as personified by the business owner) affects the innovation activity of small and medium-

sized enterprises. They described human capital as a function of the business owners' educational attainment, the duration of their schooling and the years of industry-related experience. The research revealed a direct link between education and professional experience on the one hand and innovation activity on the other. However the study stopped short of examining the impact on an enterprise's innovation activity of experience acquired whilst working in research institutions, attending training courses or using consulting services. In addition to production companies, the study extended to the predominant business organizations, i.e. trading and service companies.

In the English language literature, education and experience are the key qualities describing human resources. Studies show that formal and informal education, managerial experience and experience acquired prior setting up one's own enterprise drive people into starting their own businesses [Becker 1964].

Some authors see an entrepreneur's education as being but one of many factors behind the innovation of small and medium-sized companies [Hadjimanolis 2000; Romijn and Albaladejo 2002]. Others underscore the impact of entrepreneurs' personal profiles, including their education, on company performance and success [Calvo and Garcia 2010; Soriano and Castrogiovanni 2012]. Substantially less attention has been given to relationships between entrepreneurs' experience and innovation. Research on the influence of education and professional experience of innovation has produced results which vary by research area, company size and company maturity (on a spectrum between start-ups and well-established organizations) and the sector's technological sophistication. Examples of such research include work by Nazarow and Akhmejjonov [2012] whose survey of 1399 enterprises from 25 countries in Europe looked into the impact of experience and formal education on business innovation. Other studies concern the influence of education on the innovation of small and medium-sized enterprises in a range of regions differing in terms of innovation activity. Some of the research investigated the extent to which human resources affect small-business innovation [Hadjimanolis 2000] whilst others offered insights into medium-sized operations [Zahra, Neubaum, and Huse 2000]. As for the maturity of business organizations the majority of the research concerns companies well-established on the market [Romijn and Albaladejo 2002]. Fewer research projects have focused on start-ups (defined as business organizations having been in operation for up to 3 years) [Lynskey 2004]. A 2003 study of 637 Belgium-based start-ups linked companies' entrepreneurs and employees which have developed innovations [De Winne and Sels 2010]. Other research addressed the influence of proprietor educa-

tion and experience of radical innovation in high-technology companies [Marvel and Lumpkin 2007]. A small proportion of studies concerned the impact of human resources on innovation in low-tech ventures [Roper 1997; Macdonald and Assimakopoulos 2007]. This suggests a need for investigating the effect of entrepreneurs' educational attainment and experience on innovation activity in companies operating in traditional industries.

2. Innovation activity amongst Wielkopolska-based businesses

In view of the specific nature of small and medium-sized businesses, SME innovation activity was assumed to take place both in-house and externally and be aimed at launching new products, improving existing products, processes and organizational solutions and conquering new markets [Mizgajska 2002, p. 48].

This view of innovation is slightly broader than the commonly accepted definition of product and process innovation. According to the Oslo Manual [2005] product innovation involves launching products or services that are new or whose features or applications have been significantly improved. On the other hand, process innovation entails adopting new or significantly improved production or delivery methods. The available research findings additionally extend the notion of innovation to encompass minor product and process improvements as well as their diversification.

Table 1 summarizes the outcome of research on innovation activity pursued regularly between 1994 and 2013 by small and medium-sized enterprises representing the traditional industries of Wielkopolska. As the research methodologies and approaches to assessing innovation activity were consistent across all the study sub-periods, one can safely assume that the findings of each of the studies are comparable. However due to minor discrepancies in the definitions of terms such outcomes should not be compared with the data published by the Central Statistical Office which suggest that Wielkopolska's enterprises are considerably less innovative [Central Statistical Office 2012].

Regretfully due to space constraints, the authors could not discuss historic research. Note however, that Poland has seen major shifts in quality since its EU accession. A substantial rise was observed in the proportion of businesses considered to be highly innovative, i.e. those which have adopted more than 10 innovations over the last 3 years. An increase has

also been noted in the number of business organizations whose innovations are the first of their kind country-wide if not internationally. This notwithstanding, the scene continues to be dominated by ventures launching all-new or improved products whose novelty does not extend beyond their own organizations.

Table 1. Wielkopolska's innovation activity trends in traditional business sectors from 1994 to 2013

Years	Innovative companies		Non-innovative companies	
	number of organizations	%	number of organizations	%
1994–1997	298	86	48	14
1996–2000	115	97	4	3
1998–2001	103	97	3	3
2001–2004	144	88	19	12
2004–2006	24	89	3	11
2005–2007	69	94	4	6
2011–2013	47	87	7	13

Source: Own research [Mizgajska 2002, 2004; Komorowski and Mizgajska 2008; Mizgajska and Wściubiak 2010].

Interestingly, in each of the study periods, Wielkopolska's enterprises succeeded in developing more new products than new processes. Such emphasis on product innovation in the 1990s resulted from the fact that the country's machinery and equipment had been largely antiquated as companies had suffered from insufficient equity. The trend has persisted to this day, driven mainly by shortages of funds and the scarcity of links with research organizations.

Innovation continues to be inspired largely by observation of competitors, information obtained from business partners and ideas developed in-house. However very few enterprises ever recognize the potential for producing innovation in working with research institutions. Yet limited ties with research organizations are not only the result of entrepreneurs lacking the necessary awareness. Despite far-reaching changes seen recently in Poland's R&D sector, many research institutions show little interest in working with business practitioners and rely mainly on public funding to finance their operation. Research organizations do not view SMEs as attractive partners for cooperation.

3. Company characteristics

Of the 54 enterprises investigated in the study, 11.1% were micro-businesses. 57.4% fell into the category of small and 29.6% were classified as medium-sized. The most popular forms of business organization amongst the enterprises researched were partnerships (48.1%), limited liability companies (29.6%), general partnerships (11.1%) and civil-law companies (11.1%). An overwhelming majority of the companies had been set up during the transition period. Since the average company has been in operation for 14 years a great number of the ventures were not started until after the collapse of communism.

In terms of their industry structure the majority of the companies surveyed represented the food industry (20.3%), followed by metalworking (9.2%), plastics (9.2%), mechanical and automation (9.2%), furniture (7.4%), boiler-making (7.4%) and packaging production (3.7%). Such enterprises pursued the sectors most popular with Wielkopolska's SMEs, i.e. traditional industries in which competitive advantage is mainly derived from the low cost of labour. An overwhelming majority of the companies were managed by either their owners (61.1%) or their co-owners (29.6%). A meager 9.3% of the businesses were run by salaried managers whose average age was 50 years. Most of the participating entrepreneurs were men (85.2%) and only 8 (14.8%) happened to be women. Notably the surveyed businesses were run by well-educated people. This is demonstrated in Table 2.

Table 2. The entrepreneurs surveyed by education

Educational attainment	Number of enterprises	%
Higher	30	55.6
Secondary	18	33.3
Vocational	6	11.1

Source: Own research.

The managers of the surveyed companies had also invested in personal improvement and training. Over the three years in question (2011–2013) they spent an average of 11 days in training. The courses they took focused primarily on industry-related skills. To a lesser extent they provided business administration and management knowledge. Such a profile of courses appears to reflect the specific needs of the companies in question which, in the case of SMEs, are to broaden their managers industry-related expertise.

The extent of relationships with various business-support institutions is shown in Table 3. Between 2011 and 2013 as many as 82.5% of the surveyed companies maintained relations with at least one business-support institution. The greatest number of entrepreneurs worked with lending and surety institutions (35.2%), which is most likely a result of running the JER-EMIE program. Its idea was to provide micro, small and medium-sized companies with access to funding by extending soft loans and guarantees on preferential terms [Czykier-Wierzba 2013, pp. 45–46]. Relatively less interest was attracted by institutions offering technical advisory services and training in the deployment of innovations and intellectual property such as business incubators and parks of science and technology. Links with technology transfer centres, i.e. institutions responsible for transferring innovation from the academic world to industry turned out to be extremely rare.

Table 3. Cooperation between the enterprises surveyed and business-support institutions

Type of business-support institution	Number of mentions	%
Lending and surety institutions	19	35.2
Training and consulting centres	18	33.3
Industry associations	18	33.3
Chambers of commerce and industry	18	33.3
Business incubators	11	20.3
Science and technology parks	9	17.0
Technology transfer centres	1	1.8
No links with support institutions	10	18.5

Source: Own research.

4. Research findings

An assumption was made for the purposes of the study that one of the key innovation activity drivers amongst small and medium-sized enterprises is entrepreneur competence. Such competence can be described as a function of:

- the entrepreneur's formal educational attainment (rated as higher, secondary or vocational),
- professional experience acquired working in research institutions and/or R&D units of industrial companies (expressed in years served),

- training completed in the last 3 years (expressed in days of training),
- reliance on advisory services¹ offered by business-support institutions (expressed as either “used” or “did not use” advisory services).

Due to the difficulties referred to in the relevant literature [Pichlak 2012, pp. 42–51], with finding a single generally accepted measure recognized as being the most objective, the authors resorted to multiple alternative methods of assessing the innovation activity of enterprises. These relied on:

- the share of new product sales (the sales of products launched in the last 3 years) in the enterprise’s total revenues,
- the extent of novelty of newly launched product innovations (broken down into launches of products that are new world-wide, new country-wide, new enterprise-wide or an absence of new product launches),
- the number of process innovations adopted in the last 3 years,
- the number of product innovations adopted in the last 3 years.

Notably each of these individual measures refer to very different aspects of the assessment of business innovation activity. They view the phenomenon in both quantitative and qualitative terms as well as with respect to market approval for specific business innovations.

The scales adopted to assess individual innovation activity drivers and measures have been reflected in the statistical methods employed in the study. The first three of the above factors were assessed by the Kendall tau rang correlation coefficients whereas the final one (reliance on advisory services) was evaluated by the chi-square test of independence. The calculations were conducted using STATISTICA 10.0PL software. The outcomes were summarized in Tables 4 and 5.

A positive statistically significant relationship can be seen between the entrepreneur’s formal educational attainment and practically all the analyzed business innovation activity measures. By and large enterprises run by university-educated persons achieve higher levels of innovation activity.

The experience acquired working in research institutions and R&D support units of industrial enterprises translates exclusively into the qualitative aspect of innovation activity. Hence the product innovations adopted by enterprises run by persons having earned such experience tended to be more creative. Similarly entrepreneurs’ involvement in training only affected some aspects of business innovation activity. It contributed primarily to

¹ Other than legal and tax consultancies which have little effect on companies’ innovation.

increasing the number of process innovation deployments and, to a lesser extent, increasing the share of new products in the companies' overall sales revenues.

Table 4. Impact of entrepreneur competence on business innovation activity (Kendall tau rang correlation coefficients and significance level p)

Contributing factor	Innovation activity measures			
	contribution of new products to revenues	extent of novelty of product innovations	number of new processes	number of new products
Entrepreneur's education	0.255** $p = 0.008$	0.361*** $p < 0.001$	0.236* $p = 0.012$	0.174* $p = 0.061$
R&D work experience	0.107 $p = 0.263$	0.254** $p = 0.007$	0.060 $p = 0.524$	0.148 $p = 0.115$
Training attended	0.175* $p = 0.066$	0.146 $p = 0.120$	0.270** $p = 0.004$	0.091 $p = 0.332$

Significance: * $p < 0.1$ ** $p < 0.01$ *** $p < 0.001$.

Source: Authors' conclusions based on research findings.

Table 5. Relationship between reliance on consultations offered by business environment institutions and business innovation activity

Extent of novelty of newly launched product innovations	Reliance on consulting services (number of companies)		
	yes	no	total
Global or country-wide	14	12	26
Enterprise-wide or no innovation	6	22	28
Total	20	34	54
$\chi^2_{0.05} = 3.84$ df = 1	$\chi^2 = 6.08$ ($p = 0.014$)		

Source: Authors' conclusions based on research findings.

Just as in the case of the impact of an entrepreneur's professional experience gained in the course of working in the R&D field, an enterprise's reliance on advisory services offered by business-support institutions has been reflected solely in the extent of the novelty of new product innovations. As shown by the outcomes of the chi-square independence test (Table 5), enterprises benefiting from this type of support are considerably more likely to adopt product innovations which break new ground

on a global or national scale (which in itself is a major achievement for Polish undertakings).

The enterprise types compared in the study (i.e. enterprises relying and not relying on consultancy support) ranked nearly identical in terms of the share of their revenues derived from the sales of new products (20.6% and 20.4% respectively). Companies benefiting from advisory services developed slightly more process innovations (an average of 1.77 innovations per company whereas those which did not ranked at 1.46). This difference hardly appears to be statistically significant. Interestingly a greater number of product innovations were found in companies which did not receive consultancy support (an average of 7.61 innovations per company whereas undertakings which used advisory services generated a mere 5.38).

Conclusion

The study findings fully support hypothesis H1. This means that an entrepreneur's formal educational attainment is directly proportional to the innovation activity seen in the surveyed companies. The remaining hypotheses (H2–H4) have been confirmed partially with respect to selected innovation activity measures. Specifically, they postulated that:

- entrepreneur experience acquired whilst working in research institutions or R&D units of industrial enterprises affects the launch of highly innovative products (which are ground-breaking on a national or even international scale);
- entrepreneurs' involvement in training is directly proportional to process innovation activities pursued in their organizations;
- reliance on support offered by business-support institutions is directly proportional to launches of new, highly original products.

The discovery of positive impacts of entrepreneur education on innovation activity in small and medium-sized enterprises supports the findings of Szczepaniec and Jurkiewicz [2009]. The only difference is that their research suggested a tenuous relationship between education and various aspects of innovation activity which may well have been due to the large proportion of trading companies surveyed in their study (as trading companies are unlikely to generate product or process innovations).

The impact of an entrepreneur's formal education on innovation activity in small and medium-sized enterprises means that increases in educational attainment translate into an awareness of the importance

of innovation for business growth. According to Koellinger [2008], university-educated entrepreneurs know more about the state of science and technology. They are also more experienced in recognizing, examining and solving issues encountered in implementing innovative ideas. The study has shown that education is just as important for business innovation at the local level.

That entrepreneur experience acquired whilst working in research institutions and R&D units of industrial enterprises helps implement innovation has been supported, amongst others, by Romijn and Albaladejo [2002] who researched small electronics companies in the United Kingdom. Such experience makes manufacturing companies operating in traditional industry sectors more likely to adopt new, highly original products whose novelty extends to at least the national level. This insight is interesting and significant in view of the current innovation policy. The limited degree of innovation seen in the Polish economy results largely from the fact that the majority of enterprises shy away from breaking new ground beyond their own business organizations. One factor which may help overcome this tendency are links between entrepreneurs and research institutions. Studies have shown that prior relationships between business owners and R&D organizations make innovations more creative. This demonstrates the need to step up collaboration between entrepreneurs and research and development units, e.g. within the framework of EU projects.

The research showed that entrepreneurs' involvement in training (mainly in industry-related courses) has a positive impact on the deployments of process innovations. This offers a valuable insight for innovation policy makers. This is because product innovations usually entail spending on new technology. As a consequence the number of product innovations deployed by Polish SMEs exceed that of process innovations [Mizgajska 2013]. It is therefore advisable to continue entrepreneur training as organized by various business-support institutions. Access to such personal improvement opportunities may help Polish SMEs put their growth strategies on the right track and spend their funds more sensibly.

As has been discovered, entrepreneurs who have benefited from the advisory services offered by business-support institutions tend to generate product innovations that are more creative and original. Such a positive relationship proves that it makes sense for such institutions to conduct their training, information and consulting activities and transfer any R&D achievements into business practice. Considering the need to increase innovation activity among Polish enterprises business-support institutions

should, first and foremost, strengthen their efforts aimed at transferring research findings from research institutions to industry.

An idea for the future would be to extend research into the impact of employee education on business innovation activity and, in the process, account specifically for formal educational attainment, training activities and work which pre-dated experience in a given enterprise. It would also be interesting to continue to examine the collaboration between small and medium-sized enterprises operating in traditional industries and the R&D sector.

All in all, whilst the choice of enterprises to be surveyed was far from random, the limited number of enterprises examined in the study and the dynamics of the external business environment makes it imperative to interpret the data with the utmost caution.

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