COMPETENCIES OF POLISH SCIENTISTS AS A CONTRIBUTION TO THE SUCCESS OF INNOVATION RESEARCH AND DEVELOPMENT PROJECTS

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Abstract

The states which top the list of the number of conducted research and development activities put substantial emphasis on a scientist's competencies. Today, experts are able to determine the competencies that will decide on the success of projects in the next decade. They include, among others, leadership skills, team work, entrepreneurship as well as international and cross-sector mobility. What is the place of Polish scientists in relation to these competencies? What are their strongest and weakest points? How do the competencies of Polish scientists translate into the success of projects conducted in our country? These questions were to find their answers thanks to the research conducted in 2011 commissioned by the National Information Processing Institute. This article presents some of the results. It includes, amongst others, the differences between scientists from science departments and companies as well as between project managers and members of research teams.

Key words: Innovation, scientists competences and innovation projects

Introduction

Pondering the reasons for the wealth of nations, John Stewart Mill wrote in *On Liberty* [2003]: '...all good things which exist are the fruit of originality'. Innovation (lat. n*ova)* is a process that leads to a particular change. In this respect innovation should not be confused with ingenuity which is only the first stage of marketing a new solution. Chris Freeman and Luc Soete [1997] wrote (based on the classic Schumpeter's definition): 'An innovation is an idea, a sketch or model of a new or improved device, product, process or system. An innovation in the economic sense is accomplished only with the first commercial transaction involving the new product, process, system or device, although the word is used to describe the whole process'. Such a process is expected to involve not only inventors, most frequently scientists, but also specialists from other disciplines e.g. marketing. Their goal is the successful implementation of an innovative project, which should be understood as, 'a novel venture involving resources and within time, cost and quality limits'

[Kerzner, 2005], in order to achieve the set target which is the implementation of an innovation on the market. The success of such a project is not simply its implementation (operational success), but also achieving results that increase a company's competitiveness in the long term along with financial benefits (henceforth called strategic success).

Krzysztof B. Matusiak [2010] writes that within innovation one can spot three overlapping features: combining knowledge and its intellectual element with a marketing vision, pioneering and uncertainty over the final result. These types of activities are mainly conducted by employees of the R&D sector. It is this sector that requires highly specialised above average knowledge and technical skills as well as a readiness to accept risk that involves the investment of time and money in the project, the results of which are impossible to predict. The R&D sector involves the commercialisation of ideas, here however indicators in the national innovation index[7], governmental and private R&D expenditure[8], patent activities[9], etc. show a clear discrepancy between assumptions and practice. Polish issues with marketing solutions are of a systemic character, therefore overcoming these problems requires comprehensive action. A number of expert appraisals, including the analysis of best practice in R&D management conducted by the National Information Processing Institute (OPI) [10], point out that Poland still lacks systemic support for the complex work of scientific researchers, meaning: a) it lacks effective

[7] For example in issued by The European Comission Innovation Scoreboard, Poland is the fourth from the bottom, before Bulagria, Rumania and Latvia. Among others attractiveness of a research system, innovation and economic results of conducted research got the lowest scores, see *Innovation Union Scoreboard*, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf, accessed 12.09.2013; compare information in *OECD Science, Technology and Industry Scoreboard 2011*, OECD Publishing, 2011; accessed 12.09.2013.

[8] The total expenditure on R&D in Poland in 2012 stood at 0.9% of GDP. To compare, in the most R&D advanced countries total expenditure on R&D is about 5% of GDP. Compare Eurostat, *Research and Development Expenditure by Sector of Performance,* http://epp.eurostat.ec.europa.eu

[9] The number of granted European patents may serve as an example of a low patent activity: in 2012 Poland was granted 80 patents, whereas Germany received over 13 000 and in Great Britain, Holland or Italy about 2 000 each. See: http://www.epo.org/about-us/annual-reports-statistics/annual-report/2012/statistics-trends/granted-patents.html, access; 16.10.2013.

[10] The results of the research were published in two monographs: Gryzik A., Knapińska A., *Zarządzanie projektami badawczo-rozwojowymi w sektorze nauki*, OPI, Warszawa, 2012; Gryzik A. et al., *Zarządzanie projektami badawczo-rozwojowymi w sektorze przemysłu*, OPI, Warszawa, 2012. Compare also: Geodecki T. et al., *Kurs na innowacje. Jak wyprowadzić Polskę z rozwojowego dryfu?,* Fundacja GAP, Kraków, 2012.

and stimulating methods for the development of the market of financing scientific ventures, b) the level of effectiveness of cooperation mechanisms for science and industry sectors is inefficient[11], c) commercialisation of scientific results remains, for many scientific centres, a huge organisational burden and a legal challenge[12]. The problems of science financing refer not only to the manner in which public resources are distributed (including too low requirements from the public sponsor), but also their evaluation and accountability.

Poland is not the only state struggling with the problem of systemic management of R&D. The Lisbon Treaty, which was to contribute to ‘building economies based on knowledge’, was not implemented in the majority of EU countries, and we can already say that the strategy Europe 2020 diagnoses insufficiently the problem of decreased competitiveness, offering no remedy, therefore it may follow the fate of its predecessor. In order to overcome the difficulties in planning policy geared towards boosting innovation, the Polish legislator should receive the description of as many elements of the R&D sector as possible. Such health analyses of R&D sectors in Poland are frequently conducted by governmental and independent agencies [e.g. Orłowski, 2013]. The area which is overlooked is the scientists themselves [Audretsch, et al., 2010]. This gap is filled by the research conducted by OPI in 2011 on the psychological and competence profiles of scientists from the science and business sectors. It shows which competencies have the strongest link to a project’s success and measures the level of competencies among Polish scientists.

The article presents merely a part of the results of this extensive study, focussing on the problem stated above. The starting point for the analysis of the competence level amongst scientists must refer to the identification of those which, to the highest degree, affect the success of innovative projects. The presented results of the OPI research identify the competencies with the strongest link to a project’s success. In order to confirm their validity and additionally to narrow the analysis to those competencies which are today regarded as progressive, the results of scientist competencies analysis conducted abroad will be quoted.

[11] The cooperation problems between these two distinct sectors are reflected in the mentioned OPI research and among others in the analysis of the knowledge transfer centres operations. See: Kijeńska-Dąbrowska I., Lipiec K., *Rola akademickich ośrodków innowacji w transferze technologii*, OPI, Warszawa, 2012.

[12] Commercialization issues are discussed in e.g. Niewęgłowski A., *Umowy wdrożeniowe jako instrument komercjalizacji osiągnięć naukowych*, w: Lipiec K., red., *Komercjalizacja wyników badań naukowych a ośrodki transferu technologii*, OPI, Warszawa, 2011.

Therefore the overall picture of external factors influencing the working conditions of scientists, taken from the analysis conducted, will be enriched by a description of the scientists themselves. This will be done by answering the following research questions:

- Which scientist competencies will build state innovation over the next decade?
- What is the level of these competencies among Polish scientists?
- What is the impact of a scientist's competencies on the success of innovative projects?

This article is a contribution to the discussion on a scientist's role in creating innovations both on a micro (operational and strategic success of an R&D project for a company or a science department), and macro (the success of national innovation policy) scale.

Scientists' and countries' innovation – A theoretical overview

Competencies can be defined as 'characteristics that individuals have and use in appropriate, consistent way in order to achieve desired performance. These characteristics include knowledge, skills, aspects of self-image, social motives, traits, thought patterns, mind-sets and ways of thinking, feeling and acting' [Dubois, Rothwell 2004]. In McLagan's [1989] view, positive results may be achieved through 'widely varying, sometimes extremely complex, patterns of professional behaviour'. The modern understanding of competencies is fully reflected in the definition by Richard E. Boyatzis [1982]: 'competence is the potential within a man leading to such behaviour which contributes to the fulfilment of requirements for a given position within the parameters of an organisation's boundaries which triggers the expected results'. Referring the theory of competence to the science sector, one must pay attention to the fact that each change taken in response to social challenge or market requirements should involve changes in competencies of the personnel involved, in other words, scientists. The research 'Skills and competences needed in the research field objectives 2020', conducted in 2010 by L'Association pour l'emploi des cadres (Apec) and Deloitte Consulting in 8 countries with well developed research infrastructure (Finland, France, Holland, Japan, Germany, The United States, Switzerland, The United Kingdom) [13], identified 3 basic phenomena which redefined the manner of research project management around the world [Lamblin, Etienne 2010]. These include:

[13] The analysis covered the countries selected on the basis of two indices: expenditures on R&D as percentage of GDP and the number of researchers *per capita*.

1) structural changes: steering of state policy towards the development of science and technology followed by increasing funding for R&D projects;
2) increased focus on market needs;
3) new ideas and strategies for conducting research projects: regulation of intellectual property rights, promotion of interand multi-disciplinary ventures conducted in a multicultural environment[14].

These phenomena cause the world's leading research centres to perceive differently the required features of their employees. According to experts commissioned by Apec and Deloitte[15], the future will open to the scientists who, apart from their professional competences (knowledge, the ability to determine research problems and their analysis using advanced IT tools), also have managerial skills: they are entrepreneurs with well developed interpersonal and teamwork skills[16]. The analyses point to significant differences in valuing particular competences in public and private institutions. In its commercial aspect, intangible competences are valued- the highest valued are people professionally prepared, with excellent interpersonal skills in their relationships with fellow researchers and company representatives[17].

As for the prioritising of scientists' competences, similar conclusions were included in *Science and Technology Industry Outlook 2012,* prepared by the OECD. It accentuates the fact that in recent years, countries emphasised the promotion of cross-sector mobility among

[14] In recent years countries such as Australia, Finland, Ireland, Norway or Slovenia decided to open the most significant science funding programmes for foreign researchers. Moreover, Austria, Germany, Luxemburg and Switzerland encourage research of national and foreign scientists. This tendency is also reflected in educational programmes. See e.g. *Science and Technology Industry Outlook 2012,* OECD, p. 201.

[15] The experts consisted of labolatories managers, HR managers of innovation companies, universities' management, governments' representatives of the countries covered by the research.

[16] Apec & Deloitte research views the command of foreign language and awareness of research importance and their impact on external relations as beneficial for future. The identified, required personality traits of scientists include: creativity, openness, involvement, motivation and adaptive skills.

[17] Apec i Deloitte research points to the dependency of researchers competences and the level of organization development in which they operate. Similar conclusions on the impact of organization culture are included in the OPI research report (Cichocki et al., *Zarządzanie pracami B+R – porównanie profili psychologicznych i kompetencyjnych naukowców zatrudnionych w sektorze nauki i w sektorze gospodarki*, Warszawa 2011, unpublished).

scientists (knowledge-business, business-knowledge) and foreign mobility[18], they take actions to foster entrepreneurship among young researchers (business courses in Slovenia and Germany). There is growing awareness that innovation is better encouraged within the network of public organisations (research institutes, universities), companies and also suppliers and customers. For example, the level of national and international cooperation for innovation in Finland (the field's leader) stood at almost 60% [OECD 2010] between 2004 and 2006, and in Sweden, Holland and Austria at around 40%. Despite good practices in this field there are still a number of developed European countries which struggle with the problem of their policy for the development of scientific personnel who could face the challenges in the global economy. OPI research shows that this problem also includes Poland.

Research methodology

The starting point of the analysis of the competences of Polish scientists is the assessment of the importance of the development of the competences of scientists in countries with the most advanced R&D sectors.

Therefore this article takes into account only those competences identified in psychological and competence profile research conducted in 2011, which, according to desk research analysis, were considered to be fruitful in the coming years. They are:

1) **international and cross-sector mobility:** participation in foreign work experience and internships, willingness for workplace transfer and cross-sector movement;
2) **leadership:** engagement in target achievement, concern for motivational level, acceptance of responsibility for the results from teamwork;
3) **teamwork skills:** flexibility on role within a group, positive attitude towards cooperation, involvement in cooperation with other parties;
4) **entrepreneurship:** translation of research results into economic and practical benefits, potential income and costs mindset gearing.

The first feature- international and cross-sector mobility- was determined on the basis of answers gained exclusively from the demographic questions in the survey, originally not considered to be competences but as a characteristic of the whole of the research population. The respondents were asked whether in their professional career they had been on an internship in a

[18] The report mentions Australia, Canada, France, Germany and Great Britain as the countries traditionally increasing the attractiveness of their market to foreign scientists.

foreign R&D institute and whether they had had experience within a company (question to scientists) or in research departments (question to business people). In future it will be worthwhile expanding this competence analysis by questions on the type of internship, its length, location, etc..

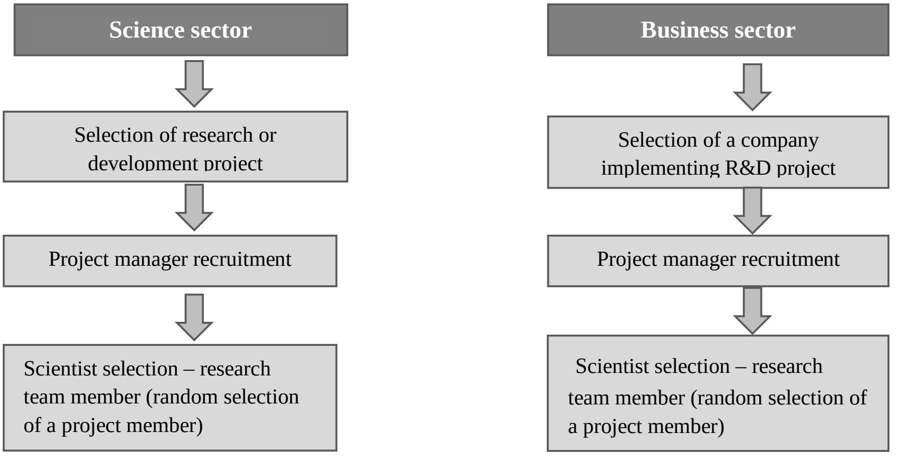
The next three features- leadership, teamwork and entrepreneurship- are typical intangible competences which affect the overall quality of tasks and cooperation effectiveness. The survey was presented in the form of a test which checked knowledge and skills.

Division into subjective and objective success has been created while looking into the impact of competences on overall project success. Particular criteria were given indices. **Subjective success** of an R&D project was based on individual answers to the question, 'To what degree did the project result in success?' (scale from 1 to 100%). The criteria of objective success were divided into:

1. Implementation of the planned tasks in the prescribed time and in accordance with the budget – **operational success.**
   Achieving results which increase an organisation's long-term competiveness – **strategic success.**
2. Due to a variety of funding principles, the strategic success of an R&D project has a different dimension in the sectors of science and business, the success index was therefore built on mutual core indices, which were complimented by indices determining a company's and research centre's competitiveness. Strategic success is a resultant of: a) accomplished practical applications, b) good financial results, c) significant scientific track record and d) commercial success (perceived as a combination of implementation success and business activity).

The index of the overall R&D project's success was constructed as a sum of weighted specific rate indices. The applied weight system includes the growing importance of strategic success, particularly in the area of implementation. Firstly, it stemmed from the above mentioned importance of success for the organisation's competitiveness and innovation in the economy. Secondly, it was triggered by a slight variability in the remaining success measurements. All the above variables were normalised, as a result of which they have values ranging 0-1. An index value closer to 1 means the greater success of a project.

The research covered scientists engaged in R&D projects in research institutions (science sector) and in companies (business sector). The term 'scientist' signifies a person who fulfils at least one of the following criteria: a) participates in R&D; b) has a doctoral degree or higher; c) is employed by a R&D institution. First, the selected R&D projects (science sector) and companies (business sector). Further stages are presented in Graph 1.



Graph 1. Sample selection diagram

Source: Own work.

The focus was only on fairly large projects from the years 2005-2011 which lasted for a minimum of one year, their minimum budget stood at 200,000 zloties and the team stood at a minimum of five people. The sampling frame of research institutions was the project base from the OPI resources (as it is the most complete collection of data available in Poland); contact details were obtained on 6167 scientists. To decide on the selection of companies, the prestigious ranking of the 500 most innovative companies in Poland was applied. It is compiled by the Institute of Economics of the Polish Academy of Sciences, based on the annual survey results; an extra source of selection is the group of companies implementing R&D projects part funded from the state budget and EU funds, as well as those companies taken from reports and publication on innovation, patenting companies and those investing in R&D. Based on internet resources, the companies chosen were compiled. Information about the implementation of their projects fulfilling the criteria was verified by phone; 647 e-mail addresses of potential respondents were obtained. An invitation was sent to all contacts from both collected bases. In all, 735 surveys were collected. 345 of the respondents held managerial positions in R&D project teams, while 390 were members of research teams. This is presented in detail in Table 1.

Table 1. Sample structure according to the scientist's role in the project and sector

Role in the project	Science sector	Economy sector	Total
R&D project managers	n=259	n=86	n=345
Project team members	n=296	n=94	n=390
Total	n=555	n=180	n=735

Source: Own work.

The survey was conducted by the CAWI (*Computer-Assisted Web Interview)* method where an anonymous questionnaire on an internet site had to be completed. The pilot study covered 19 people; it gave the basis to the final verification of the research model as well as of the validation of the research tools and individual test entries. The respondents received an invitation e-mail to take part in the research along with a link to the on-line survey. The answers given were automatically registered on the server and the research was constantly monitored by a qualified supervisor. The interviewees could also avail of a help desk if required.

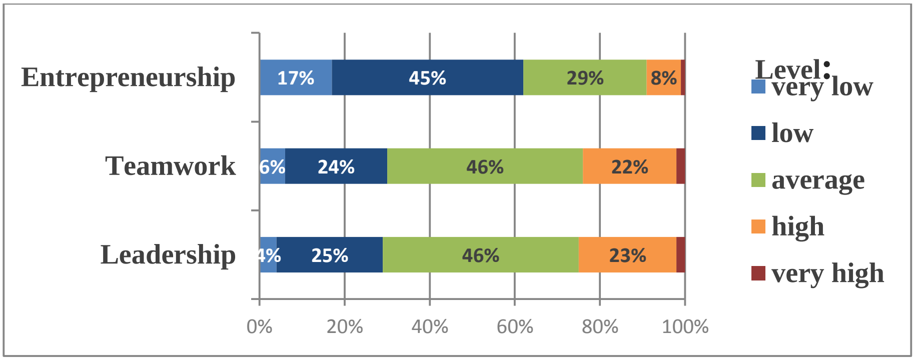
The level of competences of Polish scientists

Although the research referred to both a scientist's personality traits and their competences, attention was focussed on the latter, normally secondary to personality traits, however, significant from the point of view of R&D projects. The scientific circles from research institutions and companies were compared in respect to the aforementioned competences. The discussion on the scientists' competences, divided into the commercial and public sector, was regarded as meaningful due to their specific nature. It is worth highlighting that, according to experts engaged in preparation of the quoted foreign research, the science sector (principally to a lesser degree focussed on economic results) should develop competences facilitating the putting of product solutions into practice.

Science sector

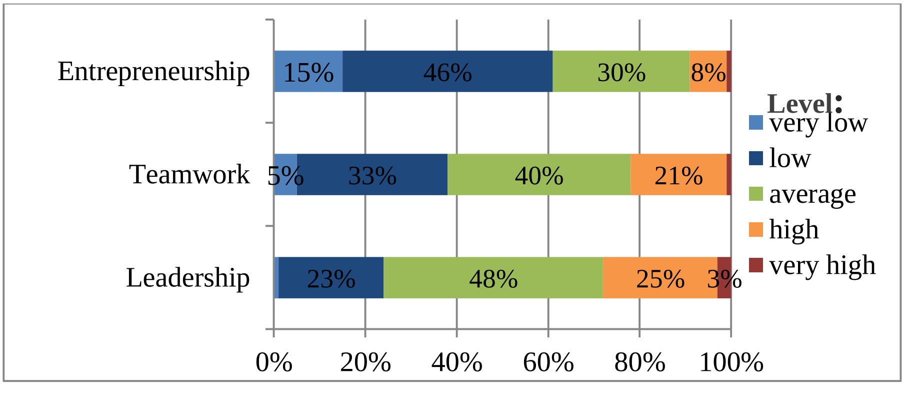
As for the range of experiences, 43.7% of R&D project managers and 29% of team members were somewhat involved with foreign universities at certain stages of their careers. Every third scientist had, in the past, worked for a company.

The intangible competences of this group were at a fairly low level. Despite the lack of reference to the population norms, they can be assessed to be average, as the medium values are close to 4 on a scale from 0 to 8. Leadership presented itself quite favourably (25% of managers and 28% of project members scored very high or high) along with teamwork (respectively 24% and 22%). However, over 60% of the managers and members scored low in entrepreneurship. Managerial competences are presented in Graphs 2 and 3.



Graph 2. Distribution of competencies of R&D project managers in research institutions

Source: own work based on research among project managers in research institutes [n=259].



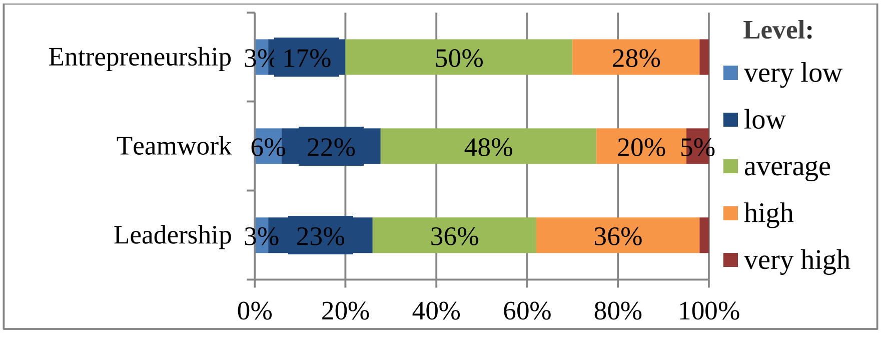
Graph 3. Distribution of competencies of R&D project team members in research institutions

Source: own work based on research among team members in research institutions [n=296].

Business sector

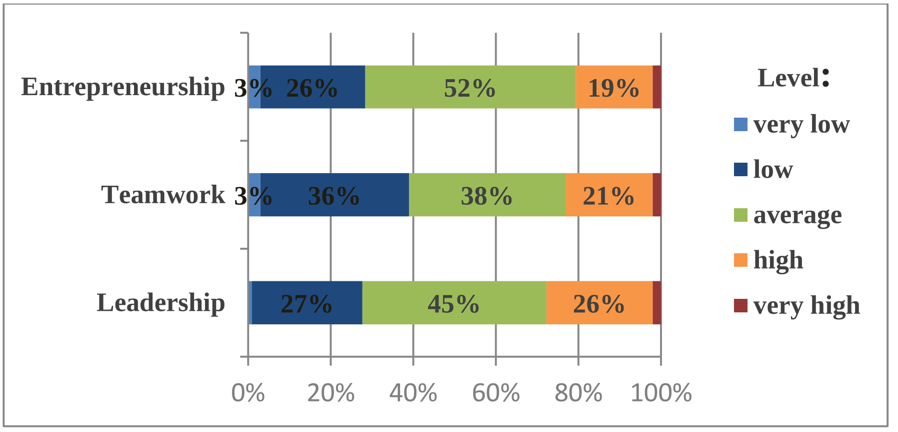
Managers and research team members gained professional experience abroad far more rarely than scientists from the state sector – only 10% of managers and 11.7% of members had such an internship. Half of the managers and 17% of team members had worked for a research institution in their lives.

As for managerial competences, as many as 80% of R&D project managers had at least average skill of translating research results into practice (in research institutions 38%). Distribution of the remaining competences looks similar, though it is worth noting that the percentage with competences above average was higher in the private sector than in research institutions (for example, in managers very high and high levels of leadership- 38%, whereas in the science sector- 25%). It is interesting that higher competences in the area of leadership were observed in managers who had previously worked for research institutions. The distribution of individual competences of research team members in comparison to the distribution of competences of their managers is similar. The detailed data is presented in Graphs 4 and 5.



Graph 4. Distribution of competences of R&D project managers in companies

Source: own work based on research among project managers in companies [n=86].

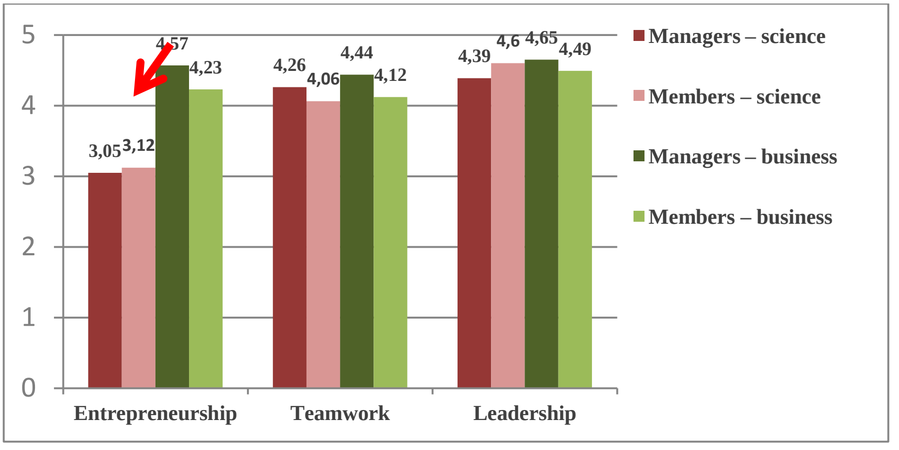


Graph 5. Distribution of competences of R&D project team members in companies

Source: own work based on research among members of research teams in companies [n=94].

The results of the competences test pointed to the fact that most interviewees had a higher level of social competences (e.g. teamwork) than personal ones (e.g. entrepreneurship). This is presented in Graph 6. Such a competence profile may contribute to the positive atmosphere in the work of research teams and good relationships between supervisors and subordinates. On the other hand there is a danger that the shortcomings in the area of personal competences will have a negative impact on the organisation of work, the quality of the solution generated and overall effectiveness, including economic.

The greatest discrepancies between employees of the state and private sectors are obviously noticed in reference to entrepreneurship. This competence was significantly higher in companies (managers- 4.57 in comparison to 3.05 in their counterparts in the science sector; team members- 4.23 in comparison to 3.12). This stems from the fact of operating in a market environment which induces improvement of the skills that turn research results into economic benefits. Their different environment and university operations means that the results achieved by researchers in the science sector should not be interpreted as wholly negative. It is worth bearing in mind that the main purpose is conducting research and educating students. The influence of research departments on economic and regional development is perceived as their 'third mission', giving priority to research and didactics. The discussion on 'entrepreneurial' or ‘innovative’ universities (in Poland) is a recent phenomena [e.g. Clark 1998, Leja 2006]. Creating innovations by scientists may have direct implications through their activities, not only being simply ‘entrepreneurial’ though, as is suggested in the literature[19] on the subject, but also shaping academic entrepreneurship in the face of the presented results has obvious merit.



Graph 6. Competences R&D mangers and R&D project team members implemented in research institutes compared with companies

Source: Own work based on research.

Competences and the success of innovation projects

What is overall assessment of a project’s success seen through the eyes of the management and participants in innovation ventures, including in the context of the differences between the science and the business sector? Does the perception of success depend on competences? In order to assess this, the respondents were requested to highlight a successfully completed project in which they participated. Among the respondents from the science institutions, about 40% of projects refer to basic research, about 30%- development work, and the remaining ventures combined these two activities. The business sector however was significantly dominated, obviously, by projects of a developmental nature; basic research stood at slightly less than 10%.

[19] See e.g.: Cieślik J., Guliński J., Matusiak K.B., A. Skala-Poźniak, *Edukacja dla przedsiębiorczości akademickiej*, PARP, Poznań – Warszawa, 2011.

When it comes to research results, the highest score, close to value 1, (in the business sector) was achieved by the index of operational success. This is understandable as the projects selected, in the respondents' view, were accomplished successfully. The average score was slightly lower for the companies' sector, which can be explained by the fact that the projects conducted by R&D departments in companies bear a higher risk, which often leads to discrepancies in reference to the planned goal.

The index of subjective success scored lower than the operational success index. Bearing in mind the project's success, respondents mentioned adherence to budget or meeting deadlines in first place, and therefore in-depth analysis caused a lowering of the subjective assessment.

The value of the commercial success index (in both sectors) turned out to be very low. In science institutions the average stood at about 0.10 (for managers) and 0,11 (for team memebers). For practical applications it was only 0.05 (for manegers , as well as for team memebers), whereas in private companies it stood at 0,09 (for managers) and 0,13 (for team memebers). This is presented in detail in Table 2.

As mentioned before, the managerial competences of project managers overall were not significantly higher than the team members. Following this idea, the assessment of the relationship between the competences of R&D project executers and the project's success was conducted both for management and research team members.

In the science sector, the analysis of overall project success revealed significant differences between project managers who had served an internship in a foreign R&D institute and those without such an experience. Such an effect was not noticed in companies, which stems, among others, from the fact that the scientists employed had rarely participated in foreign internships. A similar relationship was observed in the area of knowledge transfer between science and business (through the professional experience of employees of research institutions employed in companies and vice versa). However, it must be pointed out that the business experience of managers of the science institutions foster project success more than the experience of the scientific work of managers in companies.

Table 2. Selected features of success indices distribution

Particulars			Overall success index	Operational success index	Strategic success				Subjective success index
					Financial success index	Practical applications index	Track record index	Commercial success index	
Managers	Science	Average	0.41	0.98	0.15	0.05	0.66	0.10	0.62
		Median	0.41	1.00	0.00	0.00	0.86	0.01	0.61
	Business	Average	0.38	0.88	0.43	0.09	0.18	0.28	0.51
		Median	0.37	1.00	0.50	0.03	0.00	0.28	0.47
Members	Science	Average	0.40	0.97	0.17	0.05	0.66	0.11	0.59
		Median	0.40	1.00	0.00	0.00	0.86	0.01	0.59
	Business	Average	0.38	0.87	0.45	0.13	0.18	0.31	0.49
		Median	0.36	1.00	0.50	0.03	0.07	0.28	0.48

Source: Own work based on research

Table 3 shows, among others, that the success subjectively assessed by the project managers of the science institutions was determined by their leadership competence- people with a higher level of this competence perceived their achievements more favourably. Positive and clear, though statistically insignificant, is also the impact of team work and entrepreneurship. In this sector, commercial success was accompanied by a leader’s entrepreneurship (particularly in ventures involving simultaneous basic and developmental research). The positive impact of entrepreneurship is observed among the R&D project team members in science institutions. Interesting is the fact that in the business sector (team memebers group), entrepreneurship shows a negative correlation with project success. Project success remains therefore under the beneficial influence of a research team manager’s competences, not the members of these teams and refers mostly to science institutions rather than companies.

Table 3. Interdependencies between competences and project success in science institutions and companies

			Success indices	Leader-ship	Team work	Entrepreneurship			Leadership	Team work	Entre-preneurship
Managers	Science		Overall success index	0.01	0.01	0.04	Team members	Science	-0.04	-0.04	0.09
			Subjective success index	0.20	0.08	0.06			**-0.13**	0.04	0.08
			Operational success index	0.06	-0.02	0.04			-0.08	-0.04	0.04
		Strategic success	Financial success index	0.02	-0.09	0.07			0.04	-0.01	0.06
			Practical applications index	-0.02	-0.04	**0.14**			0.01	0.00	0.08
			Track record index	**0.12**	0.08	-0.01			0.07	0.07	0.14
			Commercial success index	0.01	-0.08	**0.12**			0.04	-0.01	0.07
	Business		Overall success index	0.12	-0.04	0.10		Business	0.07	0.06	-0.07
			Subjective success index	0.09	0.00	-0.01			-0.01	0.02	**-0.19**
			Operational success index	-0.05	0.01	0.09			**-0.18**	0.01	-0.02
		Strategic success	Financial success index	-0.07	0.11	0.04			0.13	-0.02	-0.08
			Practical applications index	0.10	0.02	0.17			0.07	-0.07	-0.06
			Track record index	-0.16	0.13	-0.05			-0.11	0.06	-0.08
			Commercial success index	0.00	0.10	0.14			0.15	-0.02	-0.07

Spearman's rank correlation and dependence; significant dependencies with $\alpha=0.10$were put in bold. Negative correlation marked in black.

Source: Own work based on research.

Summary

In this era of interdisciplinary research conducted by international teams, the managerial competences of scientists, such as leadership, ability to work as part of a team, entrepreneurship and- when treated as an introduction to competence acquisition – international and cross-sector mobility - have become increasingly significant. The presented foreign research referring to competences that build the innovation of countries for the forthcoming decades have shown this perfectly. Based on foreign prognosis, the level of these competences for Polish scientists: managers and research team members was analysed. Worryingly, the research sample shows an average level, both in the science and business sectors. This average score, calculated on the basis of a questionnaire completed by members of the science and economy sectors, is roughly value 4 on a scale of 8. Despite the lack of references to population average, it is curious there there is no difference in the level of competences between managers and project members. Such a situation would be explained by more in-depth analysis of the recruitment of project management personnel conducted in companies and universities. The research on the influence of competences on project success did not reveal clear and expected results. Analysis shows that a project's success is facilitated by entrepreneurship and foreign mobility, which corresponds well with the opinions expressed by foreign experts. In reference to Poland, it calls for sysytemic support of scientist exchange (Top 500 Innovators- internship-training programme of science departments serves as a good example). Such programmes should be expanded by activities which make scientific advancement dependent on working in various institutions, and by internships and work experiences. Especially that cross-sector experiences of scientists had a positive impact on project success.

The OPI research shows that scientists from the business sector were generally more industrious than research institution staff, which clearly stems from their daily operations in the challenging market environment. The poor results scored by the representatives of the state sector prove the call for entrepreneurial attitudes which can contribute to- still difficult in Poland- breaking the barriers in cooperation between science and business. Scientists are still focussed on 'pure' scientific work putting aside the issues of commercialisation and implementation. It is important to balance appropriately the mission of Polish research centres so they includes the implementation of the whole innovation process, meaning from idea to implementation, taking into account a company's engagement in the final stage. Without the overlapping of these two worlds it is hard to count on any significant economic success of a company or scientific organisation, and, as a consequence, on a national scale. Innovation scoreboards highlight the weaknesses in innovation implementation in Poland confirming this unequivocally.

An important question which should gives rise to further research is the surprising lack of influence of experience in scientific work of company management on project success. Unfortunately, it may prove the fact that our science sector is an enclave of good work atmosphere which does not translate into effectiveness and quality. It may also confirm the thesis of another OPI research (referring to research project management) that projects implemented in science sectors were not created in response to real problems but were merely a way to build professional careers through implementation of risk free research, easier for financial accountability to the sponsor and, in fact, unprofitable. It must be mentioned that such an attitude amongst scientists is forced by the existing research financing system and the general unwillingness of sponsors (both public and private) towards truly innovative and consequently high-risk research.

There is a call for systemic solutions to all the results presented above. Although they show that personal competences such as entrepreneurship and the international mobility of the research sample of scientists translate into project success, they are only the introduction to the description to very complex scientists' circles and do not show the full range of problems faced by this group.

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