

**MODEL OF COOPERATION BETWEEN SCIENCE
AND INDUSTRY (S2B — SCIENCE TO BUSINESS)
IN THE AREA OF IMPROVING THE CONDITIONS
OF WORK — EXPERIENCES OF THE CENTRAL
INSTITUTE FOR LABOUR PROTECTION
— NATIONAL RESEARCH INSTITUTE**



MODEL OF COOPERATION BETWEEN SCIENCE AND INDUSTRY (S2B — SCIENCE TO BUSINESS) IN THE AREA OF IMPROVING THE CONDITIONS OF WORK — EXPERIENCES OF THE CENTRAL INSTITUTE FOR LABOUR PROTECTION — NATIONAL RESEARCH INSTITUTE

Alfred Brzozowski, M.Sc. Eng.

Central Institute for Labour Protection — National Research Institute, Poland
albrz@ciop.pl

DOI: 10.14611/minib.25.09.2017.12



Summary

The paper will present the experience of the Central Institute for Labour Protection — National Research Institute in the range of its cooperation with enterprises, based on the networking structures in Poland. For enabling of introducing and dissemination of technical and organisational solutions for improvement of working conditions in polish enterprises, computer application will be made, which — in authors intention — will be complete database of products and good practices for use in any enterprise. Research (made in 2014) of S2B activity and needs of enterprises in the area of occupational safety and health (OSH) was the base of this application. Results of these research as well as concept of application operation will be presented in the paper. Suggested ways of stimulation to activity of enterprises in the OSH area will be also presented.

Keywords: safety at work, cooperation of science and industry, improvement, computer application

Introduction

In 2015 Poland's economic indicators were good, compared to other countries of the European Union. The current economic situation is also optimistic. The continuing economic growth and sentiments among entrepreneurs make it possible to hope that the role of innovativeness will be appreciated more and more. Still, according to all statistics concerning the subject, Poland is not among the leaders in this respect.

In international innovativeness rankings Poland occupies distant positions. In the European Innovation Scoreboard in 2016 Poland placed 23rd. This results from weak innovative activity among companies (especially SME's) and cooperation with other entities in this area, as well as commercialization of inventions on an international scale. However, on the other hand it is worth remembering that these statistics are not always authoritative. Scientific units (and press) often report news showing Poles' creativity. Young students win prizes in international contests.

At the same time, 2014 was another year of growth of spending on research-development activity in Poland. The spending reached the level of 0.94% of GDP, which is still below the EU average (2% of GDP in 2014)¹.

Many companies, especially companies from the SME sector don't see the need to introduce innovations to their business. Small interest in innovative activity among Polish entrepreneurs results not just from factors of economic, market-related character, but also from the factors associated with general social awareness of innovativeness. That's why it is so important to stimulate contacts between scientific units and companies. There is some hope associated with comparably fast growth of companies' interest in investing in research and development (growth of spending of the industry in relation to GDP from 0,23% in 2011 to 0,44% in 2014) ¹.

Taking into consideration the requirements of the third wave of social-economic development, changes in decisive areas of life are needed. This concerns both precise definition of the role of science, which is to a large extent responsible for the innovativeness of the economy, but also definition of the role of economic centres, whose lack of need for innovative solutions doesn't allow science to grow, as we expect.

The level of Polish science is coming closer and closer to the level of global science. This also concerns many areas of science. However, expecting that Polish industry could somehow learn to voice everything it expects from science and start financing research overnight is too optimistic. That's why solutions and procedures facilitating contacts between stakeholders and supporting their intentions to implement innovations (or this initiating intention) should be developed.

The important role of the transfer of technology and the implementation of technical progress, which eventually leads to the development of the whole country, has been recognized also by the Ministry of Development. The Plan for Sustainable Development, now subject to assessment, supports entrepreneurs, assumes raising investments and spending on innovations, as well as improving the cooperation of science and business. The plan relies on five pillars: reindustrialization, supporting innovative companies, acquiring capital for development, foreign expansion, as well as social and regional development. It assumes support for the development of companies, their productivity and foreign expansion, as well as balanced development of the whole country. There are supposed to be more investments, higher spending on innovations, as well as clearly better cooperation between science and business. The Plan also notes that the level of development of science and technological advancement determine the quality of life and standards of civilization.

The situation of comparably small interest in innovativeness is particularly apparent on the market associated with the safety of employees. This area is usually not very popular and often neglected. Many companies start cutting costs by saving on the safety of employees. Obviously, it is hard to make a worse mistake than that, as investing in safety brings tangible benefits to companies. Both financial and image related benefits, as well as minimizing losses.

Apart from the issue of financing implementations, what is exceptionally important is providing the market with modern solutions. That's why one of the priorities of the Central Institute for Labour Protection — National Research Institute (CIOP-PIB) is supporting companies by providing them with exactly such solutions, which guarantee the safety of employees. At the same time works on the construction of a model of systemic cooperation of science and industry (S2B) in this area are

in progress. This kind of cooperation should allow not just raising the number of implemented, or applied modern solutions from the area of protection of people in work process, but it should also allow the development of the culture of safety in companies.

For many years the Central Institute for Labour Protection — National Research Institute has been developing modern products and new solutions from the area of employee protection, but it has also been trying to convey this information to companies. This is not easy. That's why the Institute has found a way to convey information and pays much attention to coordinating the activity of network structures and integration of the communities of people dealing professionally with consulting and training activity, so that these structures allow reaching companies.

Research institutes are the closest partner of companies in the process of solving their problems with the modernization of production technology. Thus, they are also an important partner in the process of raising the innovativeness of Polish economy. Economic development requires both technical innovativeness and strong cooperation between all its stakeholders. Currently there is a growing demand for not just the implementation of particular organizational and technical solutions, but also for activities popularizing knowledge and strengthening the awareness of employees in the area of health and safety. Both kinds of implementations are carried out thanks to both direct and indirect cooperation with companies, institutions and social partners.

The method of activation of companies — network structures of cooperation

As conveying information about modern products and new developments in the area of employee protection to companies is not easy, CIOP-PIB also pays much attention to coordinating the activity of network structures and integration of people dealing professionally with consulting and training activity, so that the structures allow conveying such information to companies. Establishing network structures is well justified, because it "shortens" the path from the person interested in a solution to a problem to the person who can help him. This is particularly important in case of small and medium companies (SME's).

The activity in the area of cooperation with network structures was initiated at the Institute in 1998 through the establishment of the Forum of Safe Work Leaders at the Institute. Members of the Forum are institutions (especially big institutions) distinguished by particular care about work conditions. The Forum is open to companies and organizations which treat care about the health and safety of their employees as a natural, inseparable element of daily business activity. In practice this means making sure that employees get conditions allowing them to carry out their duties in a safe way, complying with the psychological and physical abilities of humans. Currently 126 companies employing a total of about 230,000 people belong to the Forum of Leaders.

Another step was the establishment in 2004, in course of activities for the improvement of safety and work conditions in small and medium companies, the Network of Health and Safety Experts certified by the Institute. This network consists of professionals striving to support these companies in solving problems associated with work safety and building a culture of safety in them. The basic goal of the Network of Experts are services for small and medium companies in the area of safety and protection of employees' health, as well as promoting the latest solutions and knowledge serving the improvement of work conditions. This task is carried out through direct cooperation of Network members with entrepreneurs and support for entrepreneurs in all their activities for the safety of employees, sometimes already at the stage of company formation. The duty of Experts as safety and health employees is providing professional services to companies (in 2016 the Network of Experts had long-term and temporary contracts for services for about 4.500 companies with a total of over 180.000 employees).

Cooperation within network structures requires continuous control of the quality of functioning of the network and raising, or maintaining the number of their members, taking into consideration possibly biggest territorial coverage of activity. The activity of the Institute as a coordinator involves above all activating the members of network structures both to actions for the employees of companies belonging to the Forum of Safe Work Leaders (and their subcontractors) and to non-commercial ventures for the benefit of SME environments (organized by Networks of Experts). Encouraging the activity of the members of

network structures is a perfect way to maintain continuous contact with the industry, acquiring information concerning its needs for pro-safety solutions and using the unique possibilities of popularization of knowledge and studies.

The activity of network structures gives the opportunity to reach dispersed recipients, who require particular support in the area of improvement of safety and health protection at work. However, also these structures don't have the capacity to reach all entities in the economy. That's why another model of cooperation with companies which don't belong to these structures is applied.

New and innovative solutions are usually more expensive than the existing solutions. This results from the level of their advancement, small batches, the need for promotion. That's why drawing the interest of companies to them is not easy. At the same time, there is a feeling among many entrepreneurs that scientific units are inaccessible in terms of prices, that the research they conduct takes a lot of time and doesn't always find use in practice. That's why it is important to adopt a model of activity that will bring about a change in these opinions.

The process of starting cooperation usually takes a long time and the partners need to get to know each other. The experiences of the Institute in this respect are based on gradual inclusion of companies in cooperation. Taking up small joint ventures (e.g. co-organization of conferences, small orders, etc.) leads to growth of trust, which later leads to more serious cooperation. What also serves the purpose of achieving this goal is signing agreements on intention. An agreement on intention, by assumption, expresses only the will of the parties to continue cooperation, defining only its framework assumptions. This allows more detailed definition of common goals and activities in the future, in form of a binding agreement, which motivates, or obliges to take joint actions.

Investigating the activity and needs of enterprises

In September and October 2014 a nation-wide survey of activities and needs of companies in terms of cooperation between science and industry in the area of work health and safety were conducted. 400 representatives

of companies — employees managing health and safety activities or performing duties in the area of health and safety in companies employing over 50 people participated in the survey. Additionally, data provided by members of the Network of Experts from 200 micro and small companies was analysed.

The survey was conducted by the ETMA research centre and CIOP-PIB. The obtained results show that over a half of the surveyed companies declared that they have a person/unit dealing with the choice and adaptation of products influencing the safety of work (it is mainly big companies that have such units). The surveyed companies eagerly seek this kind of support from external units (67%).

Over the past 10 years even 69% of the surveyed companies haven't implemented scientific solutions serving the improvement of work safety. Big companies (37% of them implemented such solutions) dominate among the companies which have done it.

The companies that declared they maintain contacts with scientific units (39,5%) conduct such activities mainly by participation in conferences and seminars and by maintaining other kinds of working contacts, e.g. in form of consultations. At the same time companies that don't cooperate with scientific units most often mention lack of needs in this area as the reasons for that (as well as for not applying scientific solutions serving the improvement of work safety and for lack of interest in cooperation with scientific units).

The conducted survey made it possible to continue earlier started directions of research aiming at maximum engagement of companies in ventures taken up by the Institute. Conclusions from the research and signals appearing in the environment (e.g. during fairs and conferences) have led to the initiative of developing a simple Internet application, which is supposed to facilitate conveying information concerning work safety to companies and drawing their interest to application of ready solutions.

Internet application BHP-IN-OUT

Developing direct contacts with companies is a natural form of cooperation, which on the one hand constitutes final cooperation delivering tangible effects, but on the other hand has a comparably limited reach. This

is where the need for introducing elements of indirect cooperation, whose reach can be multiplied through conveying information and engaging Internet as a tool, came from.

The created Internet application for the exchange of good practices and implementing solutions from the area of work safety (under the working title BHP-IN-OUT) functions as a platform for the exchange of information and enabling contacts between interested parties, which eventually may lead to direct implementation of technologies and products from the area of health and safety at work. Thus, the goal of creation of the platform is:

- allowing the presentation of held solutions, works, technologies and/or good practices from the area of health and safety, which can be disseminated, or implemented
- facilitating the exchange of information and creating new connections between entities interested in improving work conditions
- support for the transfer of technologies concerning health and safety between scientific and industrial units
- support for the popularization of good practices in the area of health and safety among entities operating on the territory of Poland.

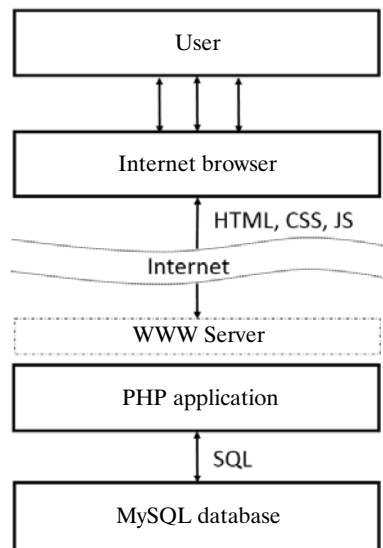
The operator of the platform is CIOP-PIB (currently the platform is undergoing tests and isn't accessible to the general public yet). Every user will have an individual profile allowing him to use the platform (the requirement is filling out a registration form and positive verification of the correctness of the entered data).

The platform can be used by both the Users using its databases, that is those interested in the application of tested (or implementation of newly developed) technical, technological solutions, works, good practices from the area of health and safety, as well as by the Providers who provide the solutions they have for the purpose of their popularization, or implementation. The benefits for the first kind of users are obvious and result from the utilization of ready models, at the same time the benefits for the Providers are undoubtedly the popularization of good practices used in a company, the promotion of a company, or implementing a solution in commercial practice.

The platform will also have the functions of "reporting" needs for solutions not available in the database. For the purpose of looking for technical, technological solutions, papers, good practices, or other solutions from the area of health and safety for application in your activity, you need to fill out the *Need reporting card* and for the purpose of presenting a technical, technological solution, a paper, good practice for popularization, or implementation, it is necessary to fill out the *Solution reporting card*.

The mechanism of the platform was developed on the basis of PHP². MySQL³. database is used for collecting data. PHP was used to create all mechanisms of the application. This includes a set of functions, which are supposed to, on the one hand, handle the actions of the user, and on the other hand, provide access to the database. The effects of the functioning of the application take the shape of a standard description of a WWW website (HTML code, CSS styles and Java Scripts). The content prepared this way is conveyed by means of a WWW server to the user's browser. Communication with the database is conducted on the basis of the SQL language.

Picture 1. Application diagram



Source: Author's own study — P. Budziszewski.

The system currently contains 3 basic kinds of data (further development is planned). The screens of these 3 parts are presented below:

1. Good practices
2. Products (example screen below)
3. Reporting units

Picture 2. Sample screen "Products"



Source: Authors' own study — P. Budziszewski/A. Brzozowski.

Ad. 1) Good practices

For the purpose of allowing the usage of good practices by everyone, in the editing mode (after logging in) it is possible to describe these practices in detail, by filling out the fields shown on the fragment of print screen.

Picture 3. Part of the screen "Good practices"

Lista praktyk

Opis:

Dodawanie praktyki

Nazwa dobrej praktyki

Rodzaj rozwiązania

Opis rozwiązania

Słowa kluczowe

Gdzie zostało zastosowane

Uzyskiwane efekty

Potencjalne zastosowanie

Jednostka zgłaszająca

Wyślij **Wstecz**

Source: Author's own study — A. Brzozowski.

Picture 4. Part of the screen "Products"

Lista produktów

Opis produktu:

Dodawanie produktu

Dane ogólne

Nazwa

Opis

Słowa kluczowe

Cechy produktu

Typ produktu

Rodzaj produktu

Cechy charakterystyczne lub wyróżniające

Parametry techniczne

Zastosowanie

Status

Ochrona patentowa

Jednostka zgłaszająca

Wyślij **Wstecz**

Source: Author's own study — A. Brzozowski.

Ad. 2) Products

Adding products makes it possible to build a database of solutions which can be both used non-commercially by users (by consent of those posting them, according to the regulations of the portal) and can be commercialized by producers interested in them.

For the purpose of letting everyone interested in products use them, in the edition mode (after logging in) in it is possible to describe these products in detail by filling out the fields shown on the fragment of print screen.

Ad. 3) Reporting units

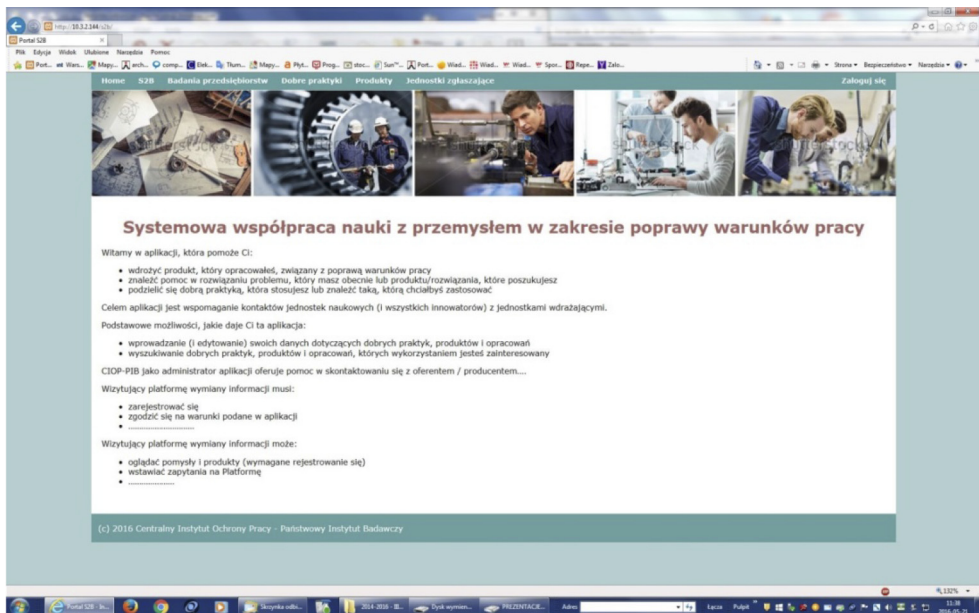
Similarly, in the field titled "Reporting units" every reporting individual has to enter appropriate identification data.

The in-built tables contain also information not visible directly to the user, among others:

- unique *id* number of every entry,
- dates of creation and last edition of an entry,
- identification of the user — owner of an entry.
- password,
- level of access (*ordinary user, or administrator*).

The contents of the portal can be viewed by everyone, without the need to log in. Users who have an account without the rights of an administrator (*called ordinary users*) can enter data into the database. They can also edit the data they entered. The group of users-administrators can edit data entered by other users. The starting screen is presented below:

Picture 5. Startup screen



Source: Authors' own study — P. Budziszewski/A. Brzozowski.

In order to encourage users to use the portal and justify the purpose of building the portal additional screens have been introduced. The screens contain:

- Conclusions from the implementation of the project of building the rules of systemic cooperation of science and industry in the area of work safety,
- Algorithm of conduct (from the point of view of a scientific unit) in the above-mentioned scope,
- The results of research conducted in the area of companies' interest in building such cooperation.

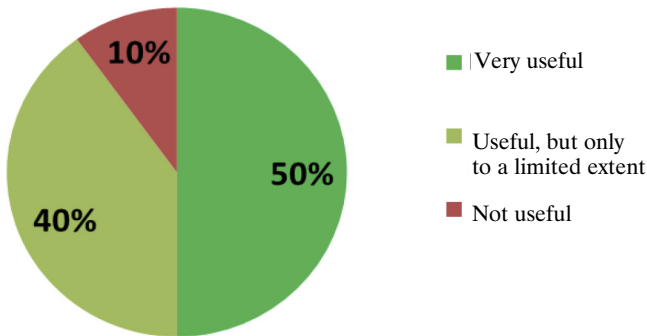
Investigating the usefulness of the application

In order to build an efficient and systemic cooperation of science and business (S2B) in the area of improving work conditions, it is necessary to verify, whether the solutions prepared above are efficient. That's why entrepreneurs were asked about their approach to the developed tool. A focused survey was conducted on a sample of 39 big companies, which belonged mainly to the Forum of Safe Work Leaders (but not just to this group). The survey contained questions concerning:

- the usefulness of the portal
 - for companies looking for good practices/products
 - for companies willing to promote and share their good practices/products
- identifying the part of the portal that would be most popular among users:
 - entering information
 - looking for information
- possibilities of entering without help information about:
 - good practices used in a company
 - products used in a company
- the assessment of a tool in terms of its user friendliness
- the degree of interest in using the portal
- the usefulness of the portal in practice
- purposefulness of further development of the portal

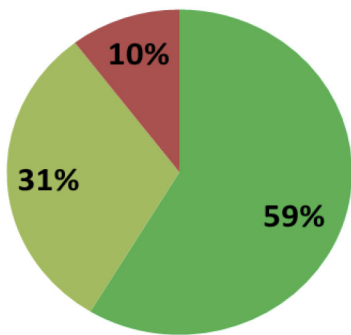
In the area of usefulness of the portal for companies looking for good practices/products the following distribution of answers was recorded:

Picture 6. Study of usefulness of "Good practices" application



Source: Author's own study — A. Brzozowski.

Picture 7. Study of usefulness of "Products" application

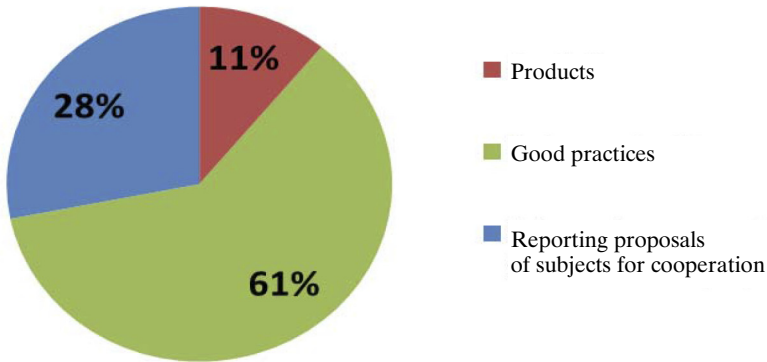


Source: Author's own study — A. Brzozowski.

Similar results (a total of 90% interest) were recorded in the area of usefulness of the portal for companies willing to promote and share their good practices/products:

At the same time, in order to identify the part of the portal that would be most popular among those interested in entering information:

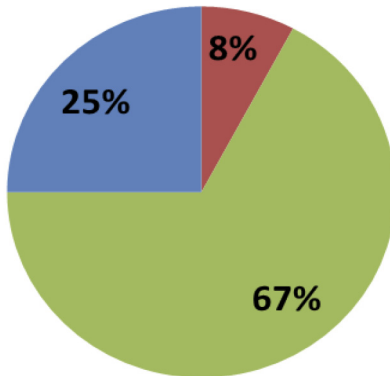
Picture 8. Study on "Which section of the portal could be used by people inputting information?"



Source: Author's own study — A. Brzozowski.

Or among people looking for information:

Picture 9. Study on "Which section of the portal could be used by people searching information?"



Source: Author's own study — A. Brzozowski.

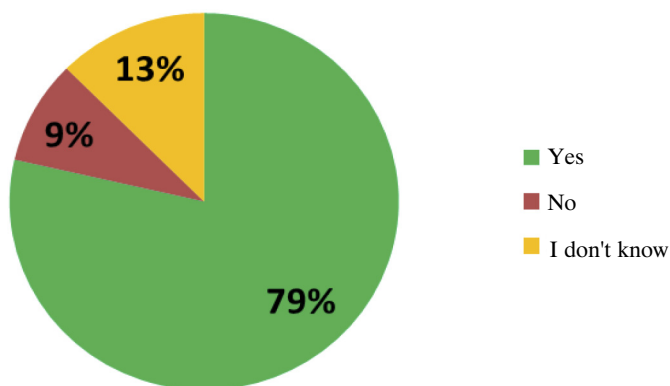
The answers to the last two questions suggest that respondents are most eager to use good practices (67%), and were eager to share them too (61%). What's interesting is that a comparably high percentage of respondents would like to have the opportunity to offer cooperation in the area of solving own problems (28%) on the forum of the portal, but also would like to help solve problems (25%).

Also, questions concerning the independence of the process of entering information about products and good practices were asked. The responses show that only a small percentage of the respondents would be allowed to enter information independently (12–16%), as the same time most respondents (about 60%) could do it after receiving the approval of the management.

The assessment of the tool in terms of user friendliness was positive (11% of the respondents recognized the portal as not very friendly).

The last questions concerned the usefulness of the portal for representatives of companies. Vast majority of them (68%) concluded that information about products and good practices will be very useful and that the portal should be developed in the future (68%). At the same time, already at this stage 79% declared that they will be interested in using the portal:

Picture 10. Study of interest in using of the portal



Source: Author's own study — A. Brzozowski.

Conducting verification survey on the sample of big companies concerning the presented concept for the functioning of the application made it possible to draw the conclusions that companies are open to the proposed solutions and actually expect them. The conducted interviews confirmed that on the market there is no single place, or tool which would systemically gather solutions, products, or good practices available on the market and at the same time which would allow reporting research problems for solving (obviously, this concerns a place, or tool with a profile

focused on one area). Similar focused research on a group of small and medium companies (members of the Network of Health and Safety Experts) confirmed the need of the community dealing with safety at work for such solutions.

Summary

The issue of insufficient innovativeness has been discussed in Poland for many years. Many solutions and technical facilities aimed at solving this problem have been created and still are being created. However, these solutions are not delivering satisfactory results. Perhaps, it is because they try to solve all problems at once. Perhaps making small steps forward would bring better effects.

Obviously, the basic thing is creating a good climate for innovativeness. Priorities of this kind are included in new programmes, both international programmes (such as Framework Programmes of the European Union) and national programmes (e.g. *Strategy of innovativeness and Efficiency of the Economy*⁴). Already the *Lisbon Strategy* published in 2002⁵ mentioned "creating favourable conditions for the formation and development of innovative companies, especially in the SME sector" as one of priority actions. Over the past few years a strong interest of scientific, governmental, business and media circles in the subject of cooperation of business and science in the area of technology transfer, implementation of innovations and commercialization of knowledge has been observed. What also highlights the importance of this issue is the number of organized conferences, debates and publications concerning the cooperation of science and business.

The sides involved in this process are institutions from the scientific-research sphere, innovators (companies), innovation centres (institutions of the business environment such as technology and industrial parks, technology transfer centres, business incubators), innovation financing funds and providers of consulting, training and information services. New portals are created (e.g. by the Industrial Development Agency, National Information Processing Institute). They concern broadly understood innovations.

However, most companies are generally not interested in cooperation with scientific units, which in many cases results from the lack of knowledge concerning the possibility of starting such cooperation, or from the lack of needs. If such needs appear at all, they usually come from the necessity to implement new technologies, or the will to obtain a particular certificate for a product. An obstacle for the implementation of products, even innovative products and products awarded at prestigious exhibitions and international fairs, is very limited capital of small and medium companies, as well as the fact that recipients in case of public orders prefer the cheapest products.

That's why it is so important to work out models of cooperation between science and industry (S2B — Science to Business), separate for various areas. Universal portals, or procedures of cooperation haven't brought the expected effects by now. That's why in the area of improving work conditions we use good experiences of the Central Institute for Labour Protection — National Research Institute in cooperation both with factories, as well as organizations and associations which operate in the area — on the one hand with associations of those who can stimulate demand for modern solutions (health and safety employees), as well as with organizations grouping producers, that is, those who can implement and offer such solutions.

References

¹ *Przedsiębiorczość w Polsce* (październik 2016). Warszawa: Ministerstwo Rozwoju; https://www.mr.gov.pl/media/27643/Przedsiębiorczosc_w_Polsce.pdf (accessed on: 10.11.2016 r.).

² www.php.net

³ www.mysql.com

⁴ *Strategia Innowacyjności i Efektywności Gospodarki 2020*. Warszawa: Ministerstwo Gospodarki, January 2013, http://www.kigeit.org.pl/FTP/PRCIP/Literatura/006_1_Strategia_Innowacyjnosci_i_Efektywnosci_Gospodarki_2020.pdf (accessed on: 10.11.2016 r.).

⁵ *Strategia Lizbońska — droga do sukcesu zjednoczonej Europy (2002)*. UKIE, ISBN 83-87913-38-3.

Bibliography

1. *Przedsiębiorczość w Polsce* (październik 2016). Warszawa: Ministerstwo Rozwoju, https://www.mr.gov.pl/media/27643/Przedsiębiorczosc_w_Polsce.pdf (accessed on: 10.11.2016 r.).

2. Ministerstwo Gospodarki (January 2013), http://www.kigeit.org.pl/FTP/PRCIP/Literatura/006_1_Strategia_Innowacyjnosci_i_Efektywnosci_Gospodarki_2020.pdf (accessed on: 10.11.2016 r.).
3. *Strategia Lizbońska — droga do sukcesu zjednoczonej Europy* (May 2002). UKIE, ISBN 83-87913-38-3.
4. www.php.net (accessed on: 10.11.2016 r.).
5. www.mysql.com (accessed on: 10.11.2016 r.).

Alfred Brzozowski, M.Sc. Eng., Central Institute for Labour Protection, Poland — graduate Warsaw University of Technology (Sanitary and Water Treatment Faculty) in 1985. Since 1986 he has been working for the Central Institute for Labour Protection as a researcher in the Filtration and Ventilation Laboratory. He has professional experience in research on chemical and dust hazards, air filtration, ventilation and air conditioning systems and devices. Since 1998, due to his experience in labour protection, he has been dealing with promotion, scientific information and international cooperation in that field, managing the special Centres of the Institute (Scientific Information and Promotion Centre, Promotion and Scientific International Cooperation Centre, Promotion Centre and actually — Promotion and Implementation Centre). In 2010 he complete postgraduate study of Technology Commercialisation — at the Faculty of Management at Lodz University and IC2 Institute (University of Texas at Austin). He is an author of few scientific projects, several scientific publications, papers presented at national / international conferences and educational materials. He is responsible (among others) for coordination and supervision over the promotion activities of the Institute (OSH field) as well as implementation activities.