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ORLEN

# GAME OF INNOVATION

Warsaw, 2016

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# OF INNOVATION

This material was prepared by the Strategy and Project Management Area and the Corporate Communication Area at PKN ORLEN.

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# Table of contents

# Introduction

We are pleased to present the next volume of the Future Fuelled by Knowledge series. Its purpose is to fuel the future with knowledge on the challenges facing Poland in its efforts to transform into an innovative economy.

Innovativeness is the capacity to design something entirely new and make profit on its commercialisation. Thus, the true purpose of innovation is not the invention itself, but delivering the greatest possible benefits to society. Innovativeness is the ultimate destination for entrepreneurship and yet it is a necessary condition of continued long-term economic growth once economy has been modernised.

The objective of an innovative economy is to ensure that the entire value chain, from an idea to end product, is located in the home country – in other words, to create conditions where innovations are not only developed in Poland, but also implemented at Polish companies and then exported from the country. To that end we need to:

- **prepare innovators** to generate many attractive ideas by reducing their life risk inherent in the process of developing innovations and by changing the approach to education – and this is what the first essay is about;

- **set up catalysts of innovative ideas at corporations**, so that innovative ideas and prototypes could be forged into strong links in the economy's value chain, providing benefits to enterprises – see the second essay;

- **launch a state-run mission for innovation that would support the value chain** to ensure that as many ideas as possible generate the highest possible added value, for the country and businesses alike – see the third essay.

Managing innovations by pre-defining what may be useful is ineffective. This is demonstrated by the experience of the European Union, which made a mistake of promoting specific renewable energy technologies instead of identifying climate protection as the objective and giving the market the freedom to select the optimum solution. As a result, the substantial funding incurred did not bring about a proper revolution. A better solution is a neutral approach to technology management, the one promoted in the United States, which focuses on problems and needs rather than on specific technologies. With this approach, inventors know what to look for and the industry knows which prototypes need to be developed, while the government fulfils its mission and creates jobs.

Without the government's mission, the system of innovation would develop but many prototypes funded from public sources would end up abroad. Progress would be slower and the chance to create a new industry in the country would be low.

This volume presents the story of Mr Inventive, an enterprising and creative man. It provides a context for an analysis of the rules of the game of innovation from the perspectives of:

- **the innovator** – in search of an idea, facing own deficiencies in knowledge, skills and facilities, trying to secure the first source of funding;

- **the company** – an existing 'plant' reproducing known designs, unwilling to help, and requiring specific incentives to implement innovative solutions;

- **the architect** – an organisation or institution setting the 'rules of the game' of innovation in Poland.

At each new stage of the game the players learn more and more about the innovation system, while the challenges they face evolve. This report is divided into three parts. Each consists of a description of Mr Inventive's situation, a short essay on the problems related to the creation of an innovative economy, and figures showing key elements of the problems encountered in a given area. Each part also contains recommendations.

We therefore add to the discussion on the innovation aspects of the 'Responsible Development Plan', not only indicating what to do and what not to do, but also suggesting some solutions welcomed by the business.

# Innovator's difficult life choices

## How to get the money for your own business? And why may working in a corporation seem a better option?

*Mr Inventive is an adult now and should earn his own living. When he was a little boy, he really wanted to be a cowboy. Later, he realized that a cowboy is more of a farmer, who rather walks than rides a horse. With time, career and money started to matter to him. Mr Inventive was thinking about how to make the life of a rural entrepreneur easier. Back then he did not know that what he planned to do was an innovation.*

*During his years at agricultural school, he had many ideas for making farmer's life easier and facilitating their work. 'Which way to go to make my dreams come true?', Mr Inventive asked himself, sitting on the lawn in front of the school. 'Should I get a job in agricultural trade? Or go abroad? Or maybe I should take the risk and start my own business? Where to get the money from? Mortgage my family house? What if my plan misfires? Ok, so I should get a job to earn some money first. Preferably on a good farm abroad. But, wouldn't it be a waste of time?' Fortunately, Mr Inventive's self-confidence wins.*

**Innovativeness is the capacity to design something entirely new and make profit on its commercialisation**. Thus, innovativeness is the highest form of entrepreneurship, as it involves dealing with business concepts that nobody else has dealt with before. It requires skill, ingenuity and courage. But also dedication. Therefore, any financial obstacles that might stand in an innovator's way should be cleared.

**Becoming ready to take the risk is the first major obstacle for a potential innovator.** In Poland a university graduate wishing to be an innovator has the following three options – to find employment (preferably with a large company), to go abroad (usually to work in a position that is well below their qualifications and risk regress), or to start own their business. Even though the conditions for doing business in Poland have been improving, statistically, the probability that a new enterprise stays alive after three years is still less than 55%[1]. A traditional full-time employment guarantees a regular salary, but if an employee has to work overtime to achieve financial success, there may not be much time left to bring their own ideas to life. Working in a corporation may seem to be a more attractive option then. The prospects of apparent financial stability, low risk and a predictable development path are tempting to graduates, who may be willing to give up the innovation ambitions (for some time, at first), to save some money for the start. However, several years later such people would most probably find themselves swallowed up by corporate reality.[2]

Are the barriers to starting innovative business high from the innovator's perspective? An innovator must have savings to last them for at least two years of sacrifices inherent in starting a new project. In absolute terms, the amount of PLN 35,000–40,000, which is necessary to start one's own business, is close to the amount of a typical research grant. However, usually an innovator must generate the money himself. A typical job will not guarantee such savings. Even though the proportion of people who spend all of their monthly income has been going down, only 16% of Poles are able to regularly put some money aside.[3] Thus, a potential innovator has no choice but to work in a corporation or go abroad. If he fails to save enough but the entrepreneurial gene survives, he may run a simple low-risk business which will generate profits in a short term, for example a greengrocery.

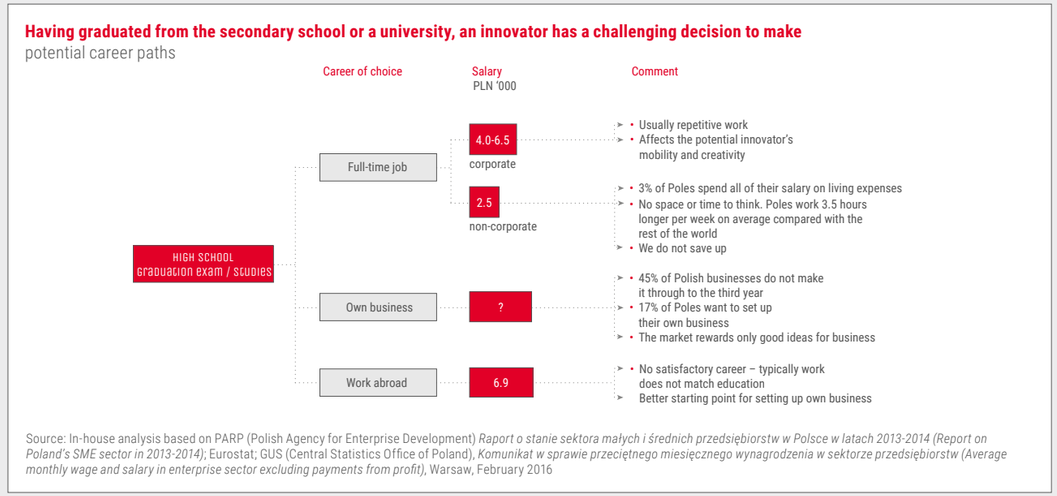
## CONCLUSIONS

Let us remove (or at least reduce) the risk faced by potential innovators, to unlock their unconventional ideas. What can help:

- Providing the wide community of graduates (of secondary schools and universities) with clear information, communicated in a simple way, about sources of financing available to micro-enterprises, support programmes, grants etc. In Poland, paradoxically, the problem is not the shortage of funding but its accessibility.
- Opening up small-scale spaces where innovative projects can be worked on, e.g. fab labs. This may fuel new ideas and bridge the gap in the opportunities available to young Polish innovators and their competitors in other countries. (A fab lab is a facility typically equipped with an array of advanced tools, such as 3D scanners , CNC turners and printers, for creating prototypes; these are also working spaces where creative minds can interact during workshops and exercises.)

The United States offer an outstanding model of how such facilities could be operated, further supported by a system of small grants, widely popular among the country's innovators. The opportunity to work in a fab lab may in itself be a grant, an idea successfully effected by MIT and its Center for Bits and Atoms. The first fab lab in Europe was opened in Barcelona.[4]

**Which career path should a graduate choose? Of the three career paths, two are not likely to generate any innovation**




Source: In-house analysis based on PARP (Polish Agency for Enterprise Development) *Raport o stanie sektora małych i średnich przedsiębiorstw w Polsce w latach 2013-2014 (Report on Poland's SME sector in 2013-2014)*; Eurostat; GUS (Central Statistics Office of Poland), *Komunikat w sprawie przeciętnego miesięcznego wynagrodzenia w sektorze przedsiębiorstw (Average monthly wage and salary in enterprise sector excluding payments from profit)*, Warsaw, February 2016

Figure 1. Three career paths of a potential innovator

[1] PARP, *Raport o stanie sektora małych i średnich przedsiębiorstw w Polsce w latach 2012–2014 (Report on the condition of small and medium-sized enterprise sector in Poland in 2013–2014)*, Warsaw, 2015, www.badania.parp.gov.pl

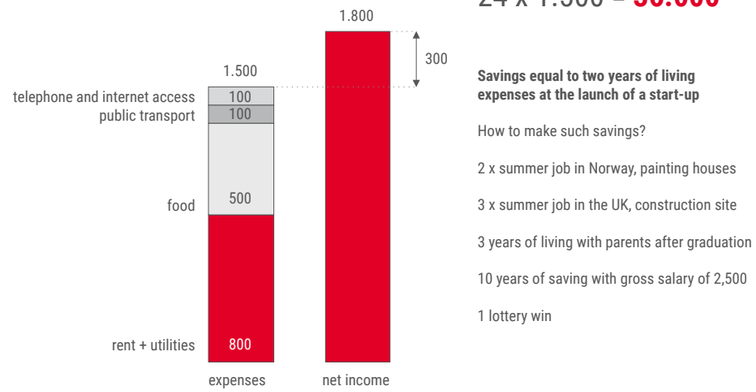
[2] E. Phelps, *Slowdown of labour productivity result of a slowdown of innovation*, 'Tehran Times', interview with Professor Edmund Phelps, Kourosh Ziabari, December 15th 2013

[3] Kronenberg Foundation, *Postawy Polaków wobec finansów (Poles' attitudes to finance)*, the Kronenberg Foundation of Citi Handlowy, September 2015

[4] *FabLab Barcelona*, www.fablabbcn.org

## 59% of start-ups are financed with their owners' savings. But how can an innovator make savings?

**The narrow difference between net income and living expenses makes it difficult to accumulate sufficient savings to start an innovative business**
PLN




24 x 1.500 = **36.000**

**Savings equal to two years of living expenses at the launch of a start-up**

How to make such savings?

2 x summer job in Norway, painting houses

3 x summer job in the UK, construction site

3 years of living with parents after graduation

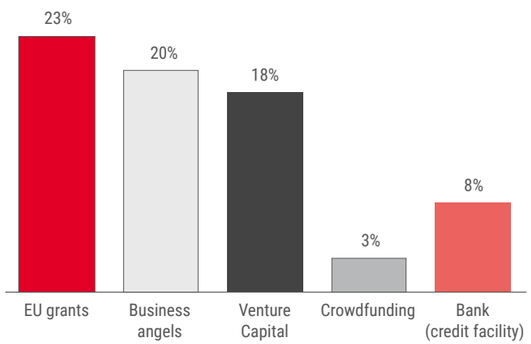
10 years of saving with gross salary of 2,500

1 lottery win

Source: In-house analysis based on the National Register of Debts, *Finansowy portret młodych (Financial portrait of the young generation)*, Wrocław 2014, www.krd.pl; Polish Radio, *Ile zarabiają Polacy w Wielkiej Brytanii? (How much money do Poles make in the UK?)*, July 26th 2015, www.polskieradio.pl; WP Praca, *Praca w Norwegii, ile można zarobić (Job in Norway, how much can you earn?)*, www.praca.wp.pl; Polish Radio, *Ile zarabiają Polacy w Norwegii? (How much money do Poles make in Norway?)*, July 5th 2015, www.polskieradio.pl; Bankier.pl; *7 lat mieszkania z rodzicami pozwoli zebrać 100 000 zł (Seven years of living with parents is worth PLN 100,000)*, www.bankier.pl

Figure 2. Balance of potential innovator's income and expenses

**Most start-ups use the financing from EU grants**
% of start-ups using a specific form of aid




Source: In-house analysis based on A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015

Figure 3. Financing sources used by start-ups





## Where do ideas come from and how do I develop them, if I wasn't taught it at school?

*The lessons that Mr Inventive has learned at school will determine his future – not only in the competitive race on the labour market, but also in the face of insecurity and the lack of hard knowledge which often accompany innovative processes.*

*'I have graduated from a university', thinks Mr Inventive, 'And every day I read in the internet about new technologies. So why can't I launch an innovative farming business? But... where to start? At school, I always started from scratch. I mean – a new subject starts, and we are back to square one. And I always knew what I had to memorize to pass the exam. But when it comes to innovation, I can't find clients who would be willing to pay for what I memorized at school. I have graduated with a 2.1. But there was just one time, and only thanks to my teacher's determination, when I completed an end-to-end project alone – I had to come up with a new product from scratch and develop it step by step.*

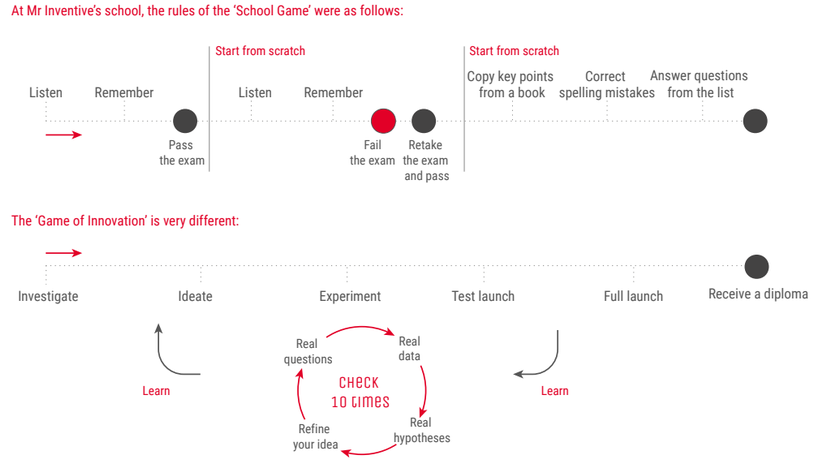
*And now I'm only beginning to grasp the way that young innovative enterprises, or start-ups, actually work – I'm getting first-hand experience. And there are obstacles everywhere. You need to prepare everything from scratch, you can't copy and paste anything, except maybe some general guidelines. Whatever I try, I always end up in a totally different place than I expected. I'm afraid to show the results of my work... Back at school, we always had a presentation after a project was completed.'*

*'But I have this idea in the back of my head', he continues. 'On a tech website, I read about new light bulbs and glass panes which accelerate the process of ripening. I work in a rural setting – so maybe that's a good idea? I will open a greengrocer's store with fruits and veggies ripening right there on the shelf, not in the cold shop. This will lower my storage costs and give me a competitive edge. 'Ripe Here, Ripe Now!''*

**Why do we put so much focus on education? First of all, good ideas are actually few and far between on the market, and they are more difficult to find than money.** The choices made by venture capital funds, which are more reluctant to extend their portfolios and more willing to engage in scouting abroad, leave no doubt. And Poland's best university ranks somewhere around the 450th place in global rankings today.[5]

**Secondly, there are a number of qualities which are indispensable to developing an innovative economy and enterprise, but are suppressed at school within the current educational framework**.

**The rules of the game we learned at school do not fit the world of innovation**
There are two educational paths




Source: In-house analysis based on *Innovation Lifecycle – bringing management discipline to innovation*, www.improvides.com, viewed May 9th 2016

Figure 4. Learning process at school and in innovation practice

[5] The Times Higher Education, *World University Rankings 2015–2016*, www.timeshighereducation.com

And we must not forget that the capital of human competences is very difficult to generate. These include such qualities as readiness to take action, independent thinking, willingness to work in uncertain and ever-changing conditions, and eagerness to promote own ideas – even if this were to undermine the existing foundations and doctrines cultivated by teachers. Where innovation is delivered through a joint effort of a group of people, which is usually the case today, the ability to work in a team gains in importance. And teamwork skills in Poland are practically non-existent. All those qualities are required not only to set up an innovative enterprise, but also to join a company that drives innovation.

**The basic problems with innovation among university graduates are not related to the choice of faculty, but rather the attitudes promoted by the current educational system**. School calls for appropriateness, while today's digitalized global village of a world promotes creative thinking. The system which pushes knowledge into our brains and expects its recreation enables the quick and predictable transfer of knowledge to a great number of specialists who will work on existing positions (for instance, if we are looking for a chemical engineer for a job at an ORLEN refinery, we will educate a chemical engineer for this specific job). However, this system is completely inadequate for the needs of an innovative economy. The ability to function in a set hierarchy and to solve problems based on algorithms will be useful in the case of a job at the Shared Service Centre of a global corporation, but not in a position which calls for creativity and problem-solving skills, independent thinking, and readiness to take action and initiative. If you are taught, every single time, to 'hit' the right answer according to the script, you start to rely on other people's opinions instead of defending your own point of view based on hard facts. School often punishes for making mistakes but rarely rewards making attempts; as such, it does not fit to the world of innovations, where only 5% of projects are successful.

**If we were to evaluate the educational system as a whole and decide if the average result of the educational process is satisfactory, we could even come to positive conclusions**. However, a system will always promote the most talented students, who in our case are potential innovators, and educate them within a fixed framework (and teach them to think within the box). If we are to translate good PISA ranks (Programme for International Student Assessment) into economic success, then the educational system must take a step forward – and not only in Poland. 'All children are born artists. The problem is to remain an artist as we grow up', said Ken Robinson, an expert in education of personnel meeting the needs of an innovative and creative economy. This shows that also other economies have a problem with the legacy of the industrial era and the lack of creativity, not only Poland.

**And the fact is, you cannot buy innovative economy; you can only create it yourself.**

## CONCLUSIONS

**It is primarily the state, and specifically its educational institutions and schools, that should encourage innovation and create a favourable environment to foster independent and creative thinking among innovators. However, human capital in an economy is a common resource which belongs to us all, and we are all responsible for its constant renewal. Therefore, companies can also contribute to unlocking the economy's innovative potential – by supporting the school system in carefully selected projects and thus putting CSR principles into practice. The third sector (NGOs) can also stimulate best practices at schools. What can help:**

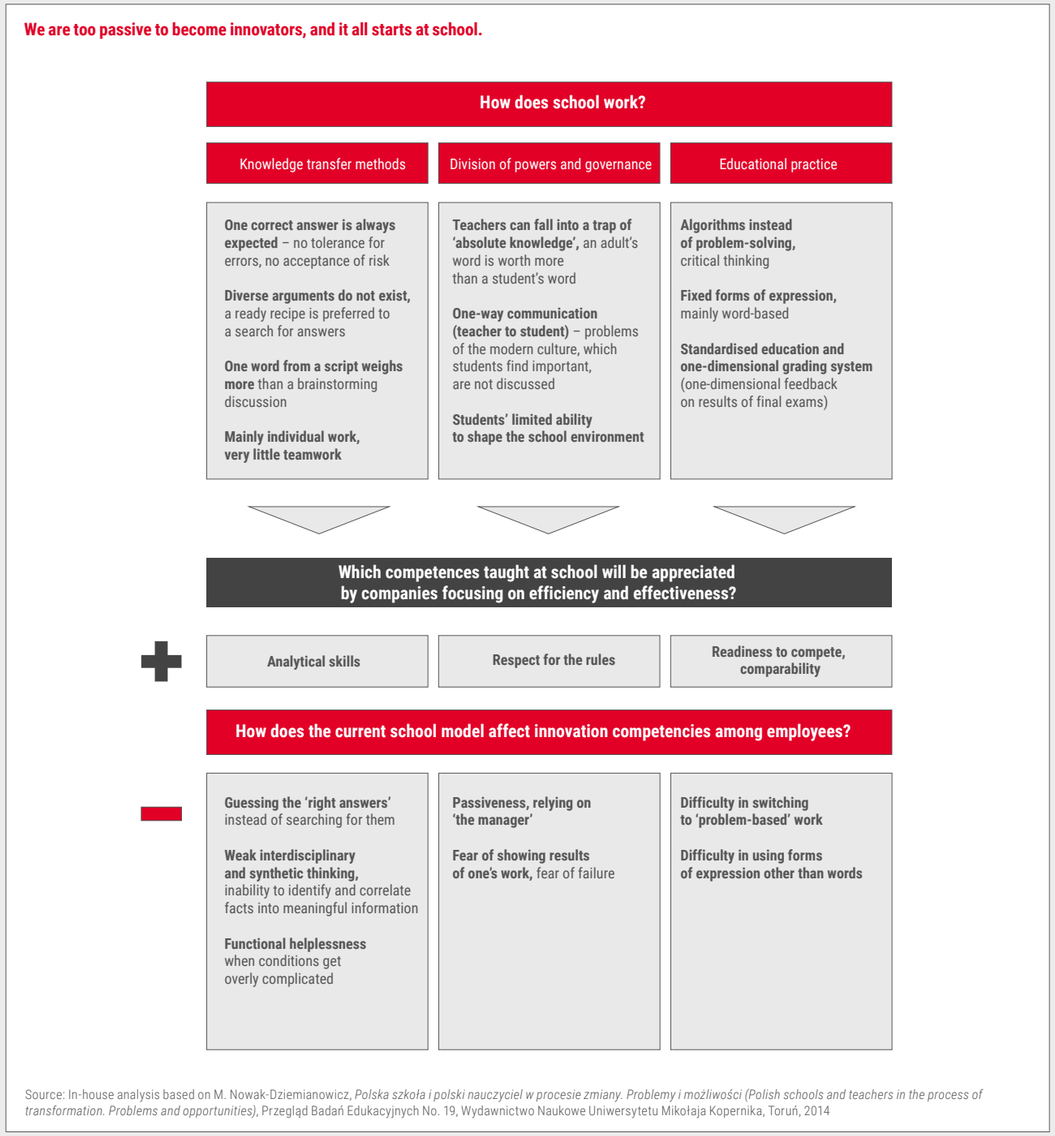
- strong focus in the educational system on the elements which improve teamwork skills, a more individual treatment of students, discovering talent;
- significant increase in the share of non-routine school tasks which require independent thinking and action; at the tertiary education level, these may include initiatives similar to those identified in the KRASP (Conference of Rectors of Academic Schools in Poland) study: problem/project-based learning and research-based education[6];
- enhancing collaboration between universities and corporations to offer hands-on experience to students;
- setting the upper limit of test-based exams, replacing the test method with creative tasks;
- introducing pilot school programmes where students move to a higher grade as they achieve certain milestones, not in line with their age;
- promoting secondary school initiatives such as theatre festivals, science camps at universities, or additional classes with university students and workshops with academic teachers.

[6] KRASP, *Program rozwoju szkolnictwa wyższego do 2020 r, część III Diagnoza szkolnictwa wyższego (Programme of Development of the Higher Education System until 2020, Part III, Diagnosis of the Tertiary Education System)*, ed. J. Górniak, Warsaw, 2015





## Which innovation competencies should be taught at school?




Source: In-house analysis based on M. Nowak-Dziemianowicz, *Polska szkoła i polski nauczyciel w procesie zmiany. Problemy i możliwości (Polish schools and teachers in the process of transformation. Problems and opportunities)*, Przegląd Badań Edukacyjnych No. 19, Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, Toruń, 2014

Figure 5. Impact of schools on innovativeness among graduates

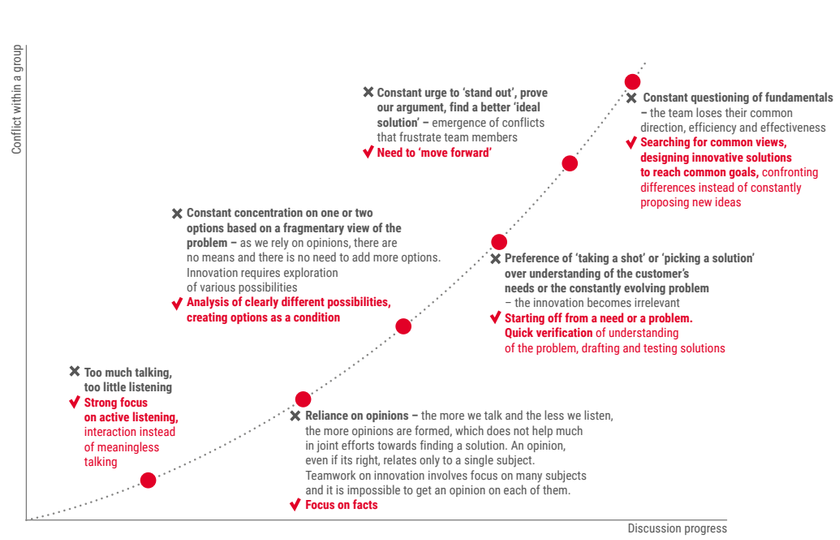
## Innovation requires teamwork. What do Polish teams need to learn to be efficient?

**The world of innovation requires cooperation between its makers**. Poles, next to Hungarians, are a nation whose individual members are most focused on domination of their environment, thus teamwork between them is very difficult.[7]

**Switching working groups from line work, where processes are divided into separate parts, to teamwork on innovations, where a joint effort is expected to bring a better result than the sum of parts, is a great challenge**. Assuming that the change of the work mode to teamwork will result in a 10% lower efficiency of a single employee compared with the baseline scenario, where processes are divided into parts, and that additional 10-20% of working time would be devoted to 'unconstrained focus on innovation', the time that would remain for traditional 'production' activities would amount to 70-80% of working time! Its use must ultimately bring a better result than in the baseline scenario. To make that possible, teamwork must be efficient.

**Without employees with inbred team spirit we can consider success of innovation-oriented efforts not remotely possible but impossible**. There are, however, certain behaviours that make the work of project groups in Poland particularly difficult. For instance, people who were taught to work individually often defend their point of view too much, which eventually leads to a lack of common direction of work. In practice, it is very easy to sow the seeds of doubt among innovators as to the overall direction of their efforts – each step may bring uncertainty. Nonetheless, teams must be ready to be consistent in their pursuit of a common objective. After a brainstorm a consensus must be worked out and ideas must converge, which is problematic. From our own experience we know that these mistakes are avoided by teams from Germany, Slovenia and Denmark. The change in the culture of cooperation must take place in academia, in corporations and in entire industries.

**We consider teamwork as an obstacle, we seek excuses not to cooperate with others**
Selected examples




Source: In-house analysis

Figure 6. Obstacles to teamwork

[7] J. Czapiński, *Patologiczny indywidualizm (Pathological individualism)*, 'Reforma kulturowa 2020—2030—2040', KIG, Warsaw, 2015





## How to set up an innovative business if I don't trust anyone?

*'University of agriculture – superb education! It teaches how to be critical and opens new horizons. It's all nothing because all my friends completed courses in agritourism and social sciences at best. To run a greengrocery I would need the help of an agronomist who would calculate the economic effect of my agricultural work! An electronic engineer who would design my neon sign. A student of physical education who would create optimum diet programmes for my customers. But if I invite people I don't know to help start my business, they will steal my idea and disappear. I'll try my cousin – he completed a course in management and marketing in a private university. He will know how to handle things,' thought Mr Inventive and picked up his phone.*

*Cooperation with a marketing specialist is a good start – innovation needs to be brought to people's attention, the market should quickly hear about the idea. But innovation will come to nought if Mr Inventive does not make a contact with a dietitian, an electronic engineer and an agronomist. Mr Inventive has a large potential, but he won't do much working alone.*

**Innovativeness by its traditional definition, i.e. development of new technologies and derivative products, is a smaller source of added value than it was only a few years ago**. The increasing pace of social and cultural changes makes it more and more difficult to reach customers. As a result, innovations in marketing, design, business processes and logistics play an ever greater role in the value chain with technological innovation becoming slightly less important in relative terms.[8] Such innovations require cooperation and mutual trust between process participants.

**Without soft infrastructure, that is a network of contacts to specialists in various fields, it is difficult to create a surprising innovation**.[9] A network helps develop creativity through contacts with people with different experiences.[10] A network of contacts can be formed when people trust one another. Poles lack such trust, which hinders the free flow of ideas and the readiness to engage in a joint effort to reach uncertain solutions. According to Ronald Burt, a sociologist specialising in sources of competitiveness in modern economies, in a network it is the entrepreneur who creates bridges between persons with different competences, who complement one another and together can achieve a desired effect, for example in the form of innovations.[11]

**Such lack of trust strongly contributes to the fact that one in three start-ups in Poland is run by sole traders**.[12] An engineer-innovator would be in a much better position if several of his contacts included entrepreneurs and graphic designers. It will be much more difficult to build such a network if he trusts only members of his family and friends, a well known and safe environment. People in his closest environment may be reasonably expected to have similar areas of expertise. Children of doctors become doctors, and children of lawyers become lawyers. Only 15% of start-ups in Poland have a scientist, at least a doctoral student, among their founders.[13]

**Trust makes it easier for start-ups to expand, reducing the cost of contract-based cooperation**. Start-ups are not burdened with a status of a corporation, which produces complex contracts used by them. A large company where there is not enough trust condemns its partners to paperwork and destroys their potential to create innovations. The more society members trust one another, the simpler the contracts that may be used, and this in turn lowers entry barriers for innovators. Lack of trust has its greatest impact on projects based on exchange of sensitive information, like intellectual property.

**In Poland, we are struggling to understand the discrepancy between bold declarations of half of start-ups on the revolutionary nature of their products and the fact that 60% of them have poor or no relations with foreign trade partners, even in the simplest form of export trade**. To be innovative means to create something that has not been thought up before. If a project is to be considered innovative, it should be original at least on an international scale, which means it should be competitive in foreign markets as well. If lack of trust prevents international contacts, our efforts do not stand a chance of becoming innovative.

**It goes without saying that the great majority of countries considered innovative enjoy a high level of social trust**, which goes in tandem with development of clusters as informal forms of cooperation and strong global focus.

**Moreover, societies which generated innovative economies (Finland, the United States, Germany) usually are not afraid of taking risks**. They generally take it for granted that there are alternative ways of development and accept a certain level of discomfort related to making a decision when an optimum solution is not fully evident. These societies simply focus on selecting an option that offers greater potential benefits than costs. It is intuitively obvious: the more efficiently we process experience and uncertainty in our heads, the easier it will be for us to explore the unknown sphere of innovation. A significantly higher tolerance for uncertainty of the effect of performed

[8] E. Bendyk, *Wyzwalanie innowacyjności, czyli o potrzebie wyobraźni strategicznej (The challange of innovation – a need for strategic imagination)*, 'Future Fuelled By Knowledge', vol. 3, PKN ORLEN, Warsaw, 2011
[9] J. Czapiński, *Zamknięte sieci społeczne (Closed social networks)*, 'Reforma kulturowa 2020—2030—2040', KIG, Warsaw, 2015
[10] *Ibidem*
[11] R. Burt, *Structural Holes and Good Ideas*, 'American Journal of Sociology', vol. 110 (2), September 2004; R. Burt, *Structural Holes: The Social Structure of Competition*, Harvard University Press, 1995
[12] A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015
[13] *Ibidem*

activities is a feature characteristic of innovative economies.[14]

**In Poland, uncertainty invokes anticipation of a sign that would indicate what is going to happen next**, and taking unusual steps contrary to proven standards is unwelcome.[15] A good example is quitting studies or a job to pursue an area of interest. After all, Steve Jobs and Bill Gates were drop-outs. Examples from innovative economies show that the opportunity cost of risk aversion 'at any price' is high.

**What values can we employ to build an innovative economy if our risk appetite is limited?** For instance, the ability to have a disciplined approach to work. We also appreciate work for the benefit of the country and the society.[16] It is quite a lot for a start!

## CONCLUSIONS

**In our efforts to build institutions supporting innovativeness we should be guided by the assumption that innovators themselves will be afraid of taking risks and of working in an interdisciplinary environment, and that their level of trust will be limited.**

- State's mission as a tool to reduce uncertainty among innovators

  According to Hofstede's classification, Poles are among societies particularly keen to avoid uncertainty and risk. This also applies to Polish innovators. To give innovation a push in the right direction a robust growth mission would be suitable, to relieve innovators from the burden of uncertainty and to allow them to be confident in addressing the needs of businesses and the state.

- Promoting interdisciplinary ways of thinking

  Grants promoting founder teams with diverse qualifications, including promotion of teams consisting of scientists and experienced businesspeople to facilitate the creation of more interdisciplinary projects showing strong potential for innovation.

  The climate of trust and confidence may also be built by educational institutions, which may give students more tasks involving interdisciplinary work to be performed by teams comprising people with various educational backgrounds.

- Building strong trust in relations between established businesses and start-ups

  Large businesses, which are like elder brothers, should help innovators break through the wall of distrust by creating mechanisms of cooperation that are as clear and simple as possible and whose terms should be comprehensible to innovators in the areas of intellectual property, offered support and expected benefits.

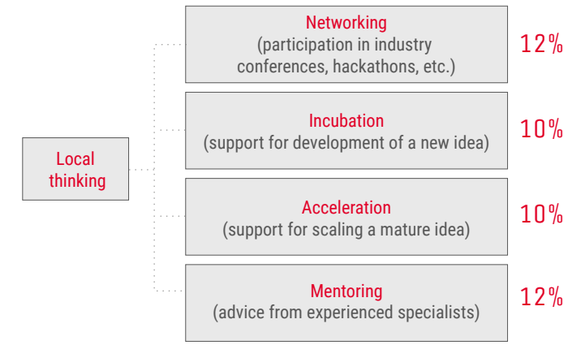
[14] G. Hofstede, G. J. Hofstede, M. Minkov, *Cultures and Organizations: Software of the Mind, revised and expanded 3rd edition*, McGraw-Hill, New York, 2010
[15] *Ibidem.*
[16] GUS, *Wartości i zaufanie społeczne w Polsce w 2015 r. (Public trust and values in Poland in 2015)*, Warsaw, November 20th 2015





## How to overcome barriers to cooperation?

**One in ten start-ups uses non-financial aid**
usually in the form of industry conferences or consultations with experienced market participants




Source: In-house analysis based on A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015

Figure 7. Percentage of start-ups using non-financial development aid

**Despite bold ambitions, in practice Polish start-ups develop in small steps. Before going international they mostly aim at winning local markets first.**

**60%** derive less than 10% of revenue from exports and 40% do not export at all

**49%** of all start-ups believe that their offer is 'innovative on a global scale' (63% of start-ups whose founders include scientists – at least doctoral candidates)

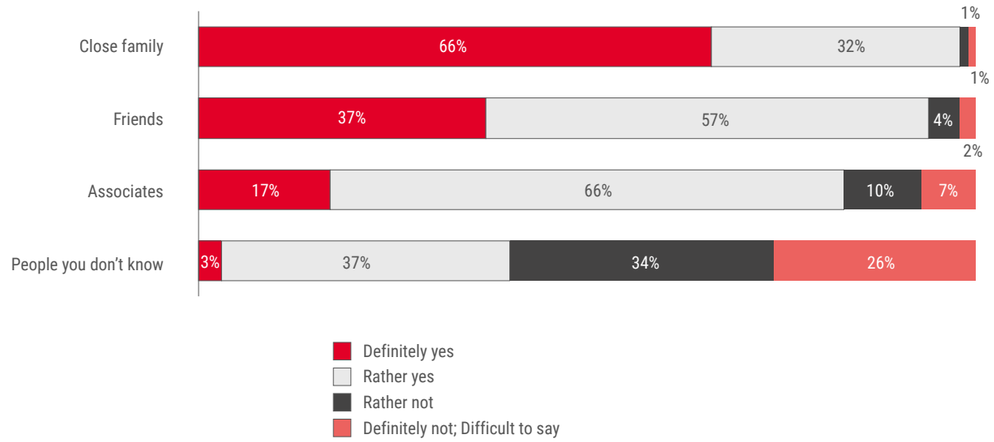
**26%** of top-performing start-ups generate more than half of their revenue from exports

Source: In-house analysis based on A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015

Figure 8. Start-ups' presence in international markets

## The reason why start-ups are so reluctant to start cooperation may stem from our social preferences – lack of trust and uncertainty avoidance

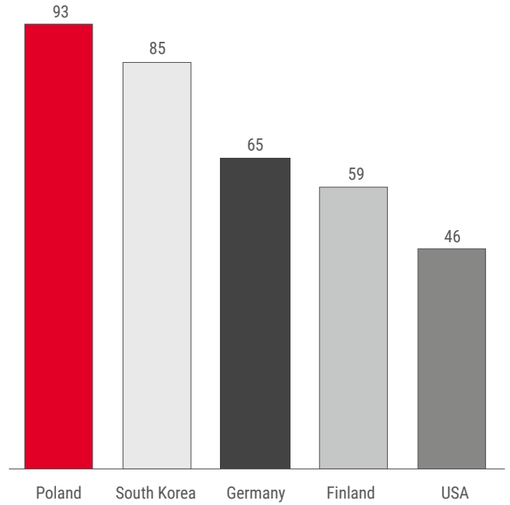
**Innovations require cooperation, but the trust index falls rapidly the further we move away from close family**
The second most trusted group is associates (%)




Source: In-house analysis based on GUS, *Wartości i zaufanie społeczne w Polsce w 2015 r. (Public trust and values in Poland in 2015)*, Warsaw, November 20th 2015

Figure 9. Percentage of respondents indicating a selected level of trust to given groups

**Uncertainty avoidance, characteristic of Poles, affects our ability to take risks inherent in innovation**
Uncertainty avoidance in selected economies, score from 1 to 100




Source: In-house analysis based on G. Hofstede, G.J. Hofstede, M. Minkov, *Cultures and Organizations: Software of the Mind, revised and expanded* 3rd edition, McGraw-Hill, New York, 2010

Figure 10. Uncertainty avoidance in selected economies

The lack of trust between innovators results in a larger number of more complex contracts and difficulties in starting cooperation with individuals with different experience. The wish to avoid uncertain situations only amplifies this effect – we often expect that contracts will cover all possible development scenarios. In the case of innovation this is impossible. Innovators must believe in the good intentions of their partners!

# The trap of modernisation culture

## It takes an internal change for a company to open up to the development of new ideas

*So Mr Inventive takes his 'Ripe Here, Ripe Now!' idea to the Agricultural Produce Trading Centre, and there he gets to the R&D department, perfectly managed by Director Plantacius.*

*'We will complete the project ourselves,' Plantacius says proudly.*

*'What about external projects?,' asks Mr Inventive.*

*'They are no match for us,' says the director. 'I have high expectations. Each project needs to have documentation of the expected benefits, KPIs, the financial model. Besides, most often the best ideas originate in our heads. Here!' says the director pointing to his head. 'I usually come up with one thing or another, sometimes the team coordinator does. Our employees – rarely. But the Head Office works like a machine! It takes three months for us to develop a project, twelve months to test it, and ten months to implement it. Everything's under control. Each step is monitored. By the way, I understand you are ready to work in the corporate mode? In a corporation, decisions are not made instantly.'*

*'You know, this idea of mine makes me so happy I can even tackle a corporation. Surely, you have successfully completed a few invention projects in, as you put it, the corporate mode, haven't you?'*

*'One project. Work is underway. A real revolution, I tell you. Vegetables are kept in a cold store and then are moved straight into the client's shopping basket.'*

*'I thought clients like to see their vegetables before they buy them,' says Mr Inventive tentatively.*

*'Why, no! They'll get them quicker, they'll be happy. As soon as they see our product. After a year of analytical work, we have finally defined the structure of the project team. You know, this person has left, another one has been hired. It did take some time. Now we already have the work schedule mapped out on a Gantt chart!'*

*'And how many clients have you talked to?' asks Mr Inventive, wondering if the project has gained any "substance" by now, apart from the structure and the analysis.*

*'They haven't seen the invention yet. We're going to take them by surprise. Just like those apple producers from California did!'*

**The innovative idea ripening in the innovator's head has reached the outskirts of the world of corporations**. But the corporation cannot work with the innovator – it had no need for such cooperation before, and now it has no resources ready. In Poland, we have had only few cases of truly successful accelerators, that is separate business units whose task is to scale a business created on the basis of an innovative prototype (it is a bit easier to show such examples of incubators, i.e. places where new ideas are 'incubated', or developed gradually). It is so despite the fact that the number of start-ups in the business-to-business market (that is, oriented towards businesses) is almost double that on the business-to-customer market (oriented towards end users), and one in every three young companies hopes to find a strategic partner.[18] Governmental programmes dedicated to embryonic businesses offer financial and development support, but contacts with potential partners, customers and their needs are what is most difficult for such external supporters to develop.

**Medium-sized and large enterprises often wall in their R&D activities within their organisations, cutting themselves off from external ventures**. This mistake is repeated by 70% of companies conducting research and development projects.[19] Quite recently, 90% of companies that considered embarking on an R&D project analysed mostly their in-house capabilities (based on a KPMG report), while 63% of them investigated intellectual property protection options.[20] This warrants a conclusion that with such an approach the range of potential partners is largely limited.

**As a result, we import technologies rather than develop our own solutions**. According to the World Competitiveness Report, we rank 54th in terms of the origin of technologies used, with a 3.3 score (where 1 stands for imitation of foreign solutions, and 7 means own research). In this respect Poland ranks lower than the Czech Republic (4.1; 22th position) and Hungary (3.5; 45th position).[21]

**Today, when the path of development through modernization** – the fastest and the most effective one in terms of income growth – is being exhausted, it is necessary to create a real pillar of innovation. Both at companies and in the economy.

**To spread the wings of innovation requires opening up to external partners to a larger extent**. First channels supporting cooperation in innovative projects with external partners are already in place, like crowdsourcing, to name just one example. It has been tested with a positive result by PKN ORLEN and will surely be continued. Besides this tool, companies have a range of options to choose from, such as incubators, accelerators, or corporate venture capital funds, the latter being a very modern instrument, but requiring experience.

**To create good conditions for a partnership between a large, process-driven company and a smaller, flexible partner, it is a good idea to set up a separate cooperation channel**. Firstly, a small partner cannot be expected to take the burden of all the processes that make large corporations operate efficiently. Secondly, and more importantly, the key responsibility of a corporation is to continue production and optimise costs. The purpose of development activities is different. They help find the answer to the questions: 'What should we do to go on?' 'How should we change?'. These questions imply an altogether different objective, different time horizon, different risk profile, and different capabilities! This is why separation is required.

**To ensure a symbiotic relation between a corporation and a start-up working together on an innovative project, both parties need to benefit from the arrangement**. In the Polish reality, this means that a corporation needs to offer access to its production processes and internal and external contact networks. Only about 10% of start-ups actively engage with the environment, and the percentage of those that make an effort to use networking and look for mentors is not much higher.[22] An arrangement where a corporation provides these resources has a value for its own sake.

### CONCLUSIONS

- Separation of a channel capable of absorbing innovative ideas would support a better use of partnerships as a source of innovation.
- More advanced businesses should consider establishing a development channel that would enable active involvement in innovation processes, for instance by offering support in business scaling.
- Such separated development channels should be prepared to work flexibly using their own procedures; reliance on traditional rules of a corporation would result in the elimination of too many ideas.

18 A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015
19 KPMG, *Działalność badawczo-rozwojowa przedsiębiorstw w Polsce. Perspektywa 2020 (R&D activities of companies in Poland. Perspective 2020)*, Warsaw, 2013, www.kpmg.com
20 *Ibidem*
21 K. Schwab, *The Global Competitiveness Report 2015–2016, World Economic Forum*, Geneva, 2015, www.weforum.org
22 A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015

## Opening up to exchange with external partners produces innovations. Crowdsourcing at PKN ORLEN

### HEAT UP INNOVATION

In April 2016, PKN ORLEN closed its crowdsourcing contest, the first global project of that scale launched by a Polish company. The company chose the crowdsourcing model to engage the global community of innovators to solve a technological problem of how to utilise low-temperature heat from distillation columns. The winning solution would help to save a lot of energy, which is particularly important for European refineries, as energy costs represent 70% of their total operating expenses.

**What were the main challenges?**

- Building an interdisciplinary team (comprising experts in areas ranging from refining to technological development, legal support and procurement functions) to be in charge of the contest.
- Working out the contest format to secure the company's interests and, on the other hand, to ease small participants' concerns about the intellectual property aspects of dealing with a company from the Fortune Global 500 list.

**What helped?**

- A clearly defined technological problem – utilisation of low-temperature heat, which is a challenge to many refineries,
- Defining the theme of cost saving, which raises no controversies within the Company – the first test of whether an organisation is ready for innovation,
- Both sides gradually becoming more willing to share their knowledge in a stage-gate process,
- Pragmatism: the objective of the contest was to find such a technological solution that would require no licence transfer,
- The process being administered by an experienced external operator of crowdsourcing platform Nine Sigma, webinars.

**What surprised us?**

- Diversity of the proposed technologies, at various stages of technical maturity, which would not only produce electricity, but also steam, cold and purified water,
- Innovations that combined technologies used in other industries proved the most efficient and attractive business solutions,
- The extent of in-house commitment necessary – to ensure that outsourcing is effective, an organisation needs a strong in-house team, which would join forces with an external partner to deliver excellent added value,
- An observation made by one of the contestants that if there had been no crowdsourcing platform, they would have never reached PKN ORLEN with their proposal – because of the scale of operations, they would not have met the strict contest requirements.

## What channels to use to capture innovations? Which channel for whom?

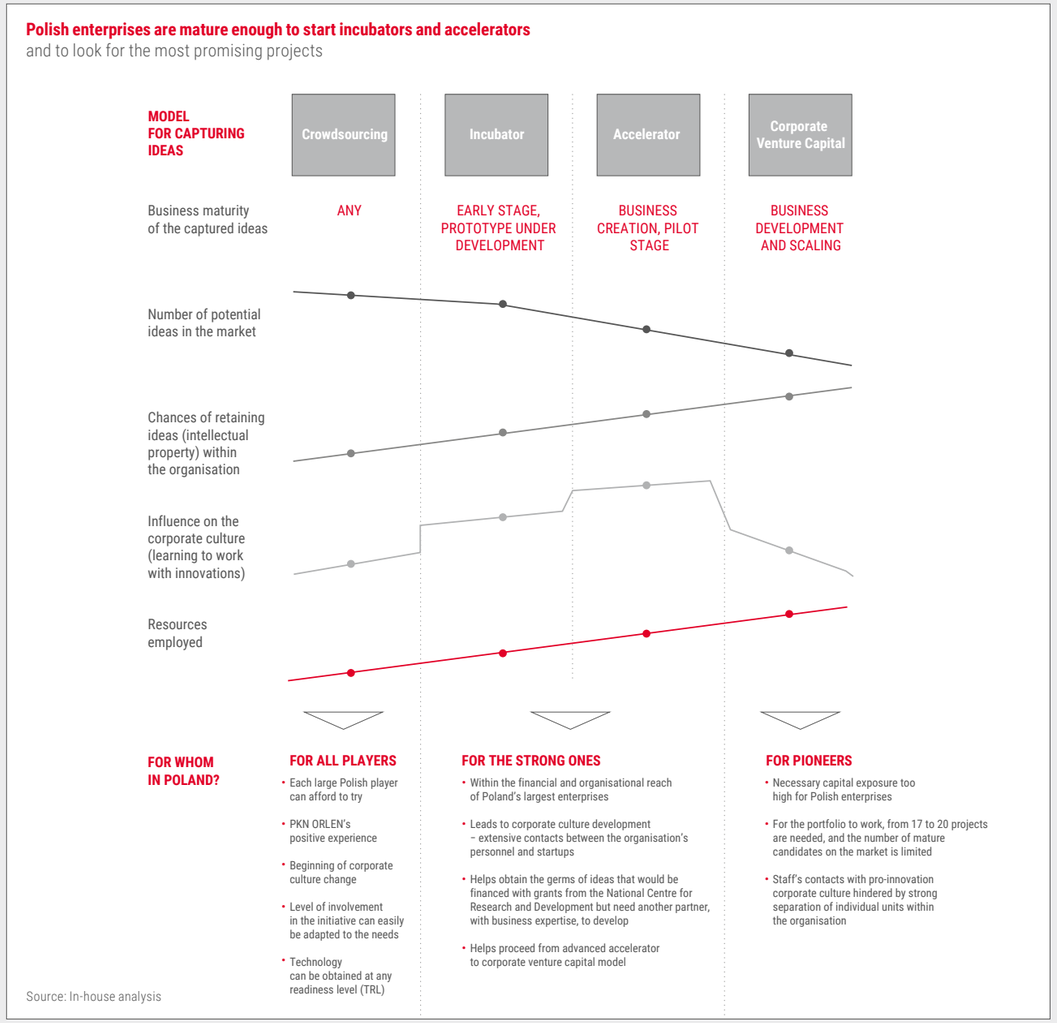



Figure 11. Channels for capturing innovation by corporations

**Incubators and accelerators may require that procurement processes be reoriented to meet the needs arise from innovation** (make-or-buy decisions and participation in the development of technology).[23] To encourage greater cooperation, businesses may also pursue ideas combining suppliers and customers, or set up strategic partnerships.

[23] World Economic Forum, *Collaborative Innovation. Transforming Business, Driving Growth*, 2015, www.weforum.org

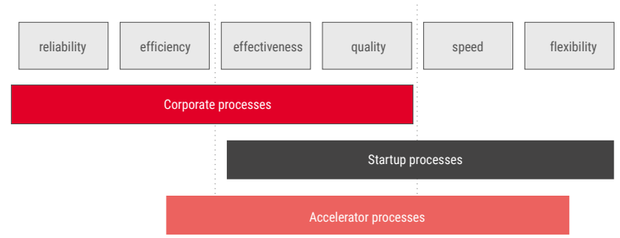
## Establishing an innovation accelerator is necessary to protect the corporate processes and offer startups access to the resources, mentors, speed and flexibility they need.

**Start-ups are there to act quickly and in a flexible way, creating and burning new business models or technology innovations.** They act in an iterative way, from sprint to sprint.[24] They usually apply the Agile project methodology (a concept borrowed from the world of IT) and Lean Startup approach, which requires frequent and quick business redesign.

**Corporate machinery works slowly**. A corporation would never achieve the current savings and reliability if it was to act like a startup. By creating an industrial structure and value chain for his refineries, John Rockefeller transformed individual oil drilling initiatives into a powerful oil industry.

**To bring two worlds together, it is worth building a 'glasshouse'** – a separate unit which would deal with development processes in accordance with its own rules. Supported by experts from the organisation and relying on the enterprise's network of contacts, it may scale a mature innovative idea, while ensuring the business's stability.

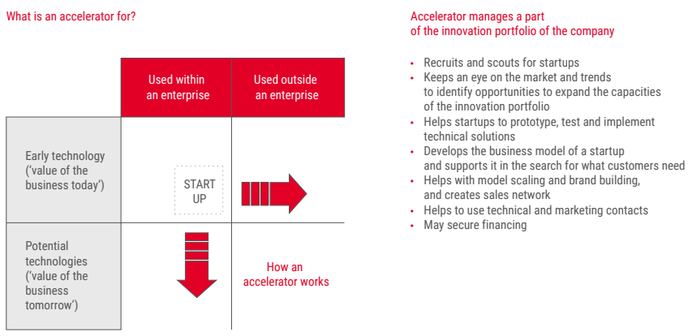
**Corporate and startup processes are optimised to fit different parameters**




Source: In-house analysis

Figure 12. Conceptual differences between corporate, startup and accelerator processes

**Accelerator supports innovation scaling**




Source: In-house analysis.

Figure 13. Accelerator as a tool to increase startup's value

[24] For more interesting information on how startups work, see the renowned blog by Steve Blank, a Silicon Valley serial entrepreneur, at www.steveblank.com





## What benefits can an accelerator bring to the enterprise?

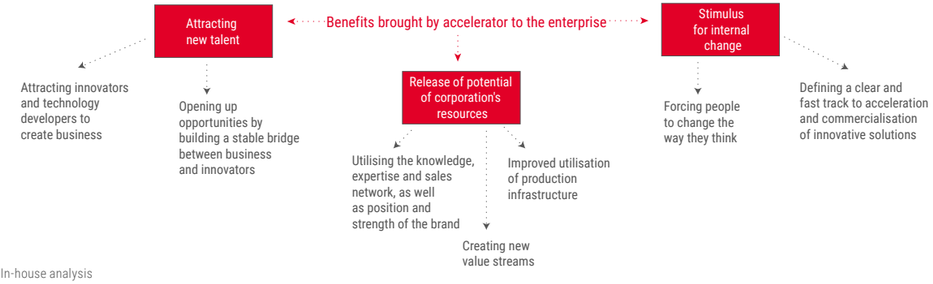
**Ultimately, a startup must grow. The observations discussed in FFBK Volume 3 'Business and the culture of innovation' confirm that only big enterprises can start building value on a large scale[25]:**

*'Innovation is not a goal in itself, but a means by which companies and other organisations should achieve their goals. The goal is thus to maximise the added value by supplying services and products – for which there might be or might appear demand – to the market. From this simple and obvious sentence many exciting consequences arise. It is not enough to have the most successful innovative bid to succeed – it mainly depends on the place one occupies in a long chain of value creation. (...) the role of technological innovation has decreased and we see a relative increase in the importance of innovation in the area of marketing, design, business organisation and logistics.'*[26]

'First mover advantage doesn't go to the first company that launches, it goes to the first company that scales.'

Reid Hoffman,
co-founder of LinkedIn[27]

**Higher productivity and flexibility in responding to the changing world are invaluable to companies**




Source: In-house analysis

Figure 14. Benefits brought by innovation accelerator to the enterprise

## What benefits do accelerators bring to startups?

Benefits that enterprises can offer to startups through accelerators:

**Opportunity to work with a 'living organism'**

- access to production facilities – opportunity to run tests
- access to sales network
- business ambassador, building relations with customers

**Access to the enterprise's infrastructure**

- laboratories
- technical experts in production and sales
- organisation's expertise (tests, insights, installation parameters)
- access to business contacts (to commercialise or start cooperation with complementary enterprises)

**Access to the corporate services, such as:**

- brand building
- training, coaching, mentoring
- sales growth, trend analysis, strategy
- legal assistance on intellectual property (although a conflict of interests may arise)

[25] Complete digital archive of Future Fuelled By Knowledge publications by PKN ORLEN, in Polish and English, can be found at www.napedzamyprzyszlosc.pl
[26] E. Bendyk, *Wyzwalanie innowacyjności, czyli o potrzebie wyobraźni strategicznej (The challange of innovation – a need for strategic imagination)*, 'Future Fuelled By Knowledge', Vol. 3, PKN ORLEN, Warsaw, 2011
[27] S. Coutu CBE, *The Scale-Up Report on UK Economic Growth*, London, 2014, www.scaleupreport.org/scaleup-report.pdf

## Innovation only makes sense when it's daring. But a company is only as daring as its employees are

*Finally! Having signed the agreement, Mr Inventive submits his project to the Analysis Department at the Agricultural Produce Trading Centre to put it in a broader context. But Mr Inventive's daring idea 'Ripe Here, Ripe Now!' begins to lose its innovative edge. Bold initial assumptions are modified, and finally the notion of 'innovation' has lost its original meaning. At the Analysis Department, the thinking is as follows:*

1. We know the Polish market best. It's big enough to absorb 30 of Mr Inventive's stores, and it's moderately competitive. There's no need for probing foreign markets, let's build an outpost in this country.
2. The Polish market is less competitive, so we don't need to look for sophisticated technologies.
3. And if so, may the technology be cost-effective. Let's focus on efficiency!
4. Technologies used in foreign markets will offer the highest efficiency, and they will be just fine for Poland. So be it!

*The conclusion is: Let's buy a foreign technology.*

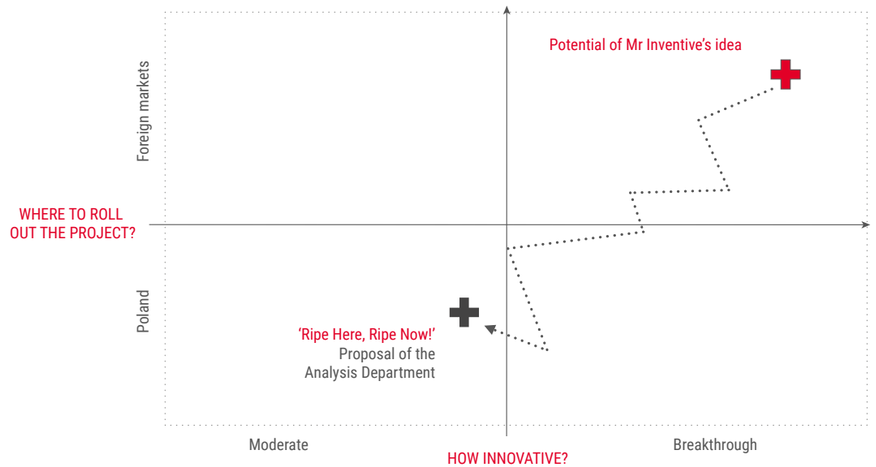
*It should not come as a surprise that Mr Inventive is not happy with that conclusion.*

*One of the deadliest sins of the planning process is to leave the decision in the hands of employees. This will inevitably lead to reduction of risk, which should be monitored at a central level. In reducing the risk, the corporation has inconspicuously moved Mr Inventive's 'Ripe Here, Right Now!' idea from a start-up project designed to market a new business model to an ordinary micro-business established merely to support the entrepreneur and his family.*

*Even if Mr Inventive did not dream of achieving global success, does he still stand a chance to create an innovative project to give a competitive edge to greengrocer's stores? He does, but only if the corporation is more daring.*

**The classic Polish innovation equals cost optimisation and small improvements.** Those two methods are used most frequently by company owners and governing bodies, the main reasons being a low risk of failure and short implementation cycle. Further, such projects are evaluated only partially: in a short-term horizon and from the perspective of the account's

**A cautious approach will take the edge off Mr Inventive's bold idea**




Source: In-house analysis

Figure 15. Innovative potential chart





**A Polish company will follow an easier low-risk path**
We rarely decide to go for more challenging and risky projects


Source: In-house analysis

Figure 16. Risk acceptance levels among corporations

bottom line. Cutting the spending on employee development will drive down current expenses and has an immediate bearing on the company's financial performance. However, in a longer term it can actually drive up development expenses due to the impact of opportunity costs of reduced spending, which is usually forgotten. As a result, it is easier to green-light an optimisation project.

**Looking for 'safe' innovations may be equally deceptive – it is difficult to distinguish between innovation and the mere copy&paste of best practices**. This trend is confirmed by sources such as the KPMG report, according to which adoption of best practices is considered by businesses as a form of innovation.[28] In turn, when planning a new R&D project 90% of companies are looking for potential benefits.[29] On the one hand, it is obvious that we should always act in our best interest and look at profits. On the other hand, does this mean that 90% of companies will nip innovative ideas in the bud, considering that the potential benefits of an innovative project are difficult to estimate ex ante? If a company decides to avoid the risk, it closes the door to success for its innovation activities. Unlike innovations, mere 'upgrades' or 'improvements' will soon become insufficient for building a competitive economy.

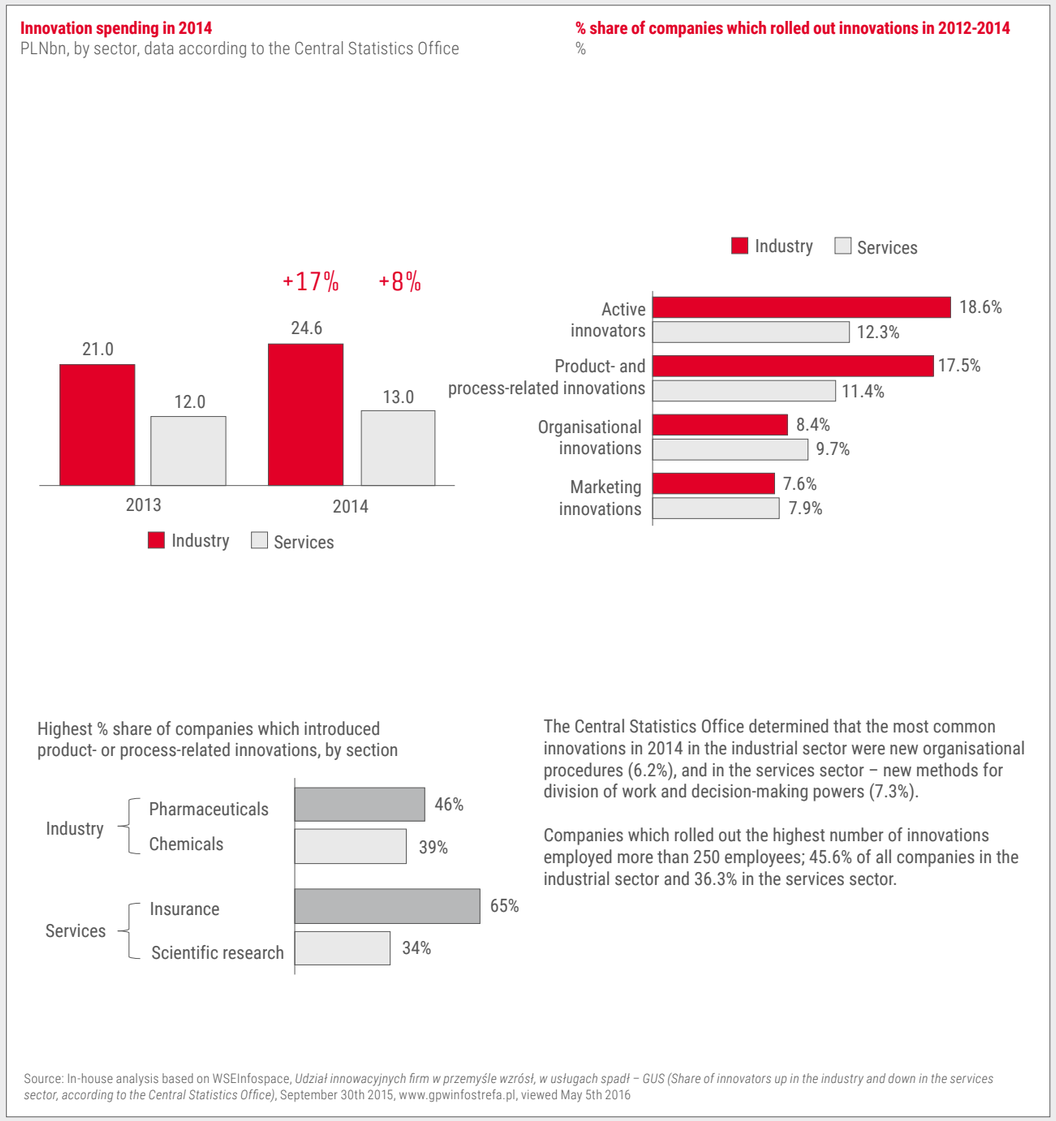
**In order to succeed, we need to change our approach to risk and responsibility.** For years, we have promoted a corporate culture based on the foundations of responsibility and openness, which unlocks the creative potential of our staff and opens the floodgates for new initiatives and ideas. Companies in the construction sector, with a fixed hierarchy established around management boards and control structures, often lose innovativeness somewhere along the way, between various management levels. The greater the number of management levels, the greater the distance between the decision-maker and the decision, and the greater the responsibility assigned to the accurate content of presentation slides. If we are serious about innovation, we should fight for the right to a second chance – and the right to fail. And remember – it is an idea that fails, not a person.

## CONCLUSIONS

- Establishing a clear dividing line between modernisation projects and innovations can help a company shape its future.
- Changes in labour law under which employees are given copyright to their own innovations, and separation and valuation of intellectual property, could unlock innovative potential.
- Reformatting jobs to allow for 'free thinking time' and creating incentives for employees will enhance the effects of innovative work.
- The company already has the tools to reward employees for their entrepreneurial spirit, for instance in the form of profit sharing if their innovations are successfully marketed.

[28] KPMG, *Dojrzałość innowacyjna przedsiębiorstw w Polsce (Innovation maturity of Polish companies)*, Warsaw, 2014, www.kpmg.com
[29] KPMG, *Działalność badawczo-rozwojowa przedsiębiorstw w Polsce. Perspektywa 2020 (R&D activities of companies in Poland. Perspective 2020)*, Warsaw, 2013, www.kpmg.com

## Only 12-18% of Polish companies are active innovators – and they are usually large-scale enterprises




The Central Statistics Office determined that the most common innovations in 2014 in the industrial sector were new organisational procedures (6.2%), and in the services sector – new methods for division of work and decision-making powers (7.3%).

Companies which rolled out the highest number of innovations employed more than 250 employees; 45.6% of all companies in the industrial sector and 36.3% in the services sector.

Source: In-house analysis based on WSEInfospace, *Udział innowacyjnych firm w przemyśle wzrósł, w usługach spadł – GUS (Share of innovators up in the industry and down in the services sector, according to the Central Statistics Office)*, September 30th 2015, www.gpwinfostrefa.pl, viewed May 5th 2016

Figure 17. Innovations in Poland according to the Central Statistics Office





## If a company decides to avoid the risk, it closes the door to success for its innovation activities

Given a choice between PLN 2,000 of cash in hand or a 23% chance of a PLN 10,000 profit, the statistically average person would almost invariably choose cash in hand.[30] We are not risk-takers, and the same is true for corporations when they make investment decisions. Rather than taking a plunge, we expect a ready-made financial model with carefully calculated ratios and precisely determined rate of return on investment in 5 to 10 years, before we take a decision. This is possible for a modernisation project, but not for an innovative project. As a result, small operational upgrades are often classified as innovations in Poland. We need to change the line of thinking and first determine the demand for our innovative product, leaving the calculation of rates of return aside, at least for the time being. Financial KPIs are not a priority in the inception phase.

## How to change the corporate culture by rewarding employees for their entrepreneurial spirit?

To open up a company to a wide array of innovative ideas, it does make sense to reward employees for taking initiative and risks.

**Innovative thinking at a company is supported by:**

- **respecting employees' copyright** to their own innovative ideas, separating and determining the value of intellectual property (if employees are not paid for innovation, and everything they do becomes the company's property, they will quickly lose motivation);
- **opening up to employees' new ideas** for products and production methods, including organisation of work;
- **introducing decentralised (transparent) mechanisms for the selection** of ideas which are to be put into practice, linked to the employees' remuneration;
- **empowering employees at lower levels in the organisation to make decisions**, to unlock and support entrepreneurial spirit;
- **paying for 'free thinking time'** (an equivalent of capital sourcing) and putting in place related incentives.

## Why do we need the 'right to a second chance' in the innovative corporate culture?

**Sixty per cent of start-up founders in Poland have previous experience in running their own business**.[31] They have already experienced failure and decided to give it a second try. More predicable business structures, especially corporations, still do not understand that most innovative businesses fail, so you have to start over and over again.

If you're not failing, you're not trying hard enough!

Failure is part and parcel of innovative business and should be bargained for. In the case of R&D projects, only 5-10% of patents have any market value, and only 1% will generate profits. If we account for failure, we can take on high-risk projects, which is the only path that leads to innovation.

**Therefore, acceptance of failure as an element of growth is a crucial ingredient of innovative culture**. The inability to differentiate between a productive failure and a pointless failure will nip the innovative spirit of employees in the bud – after all, who would want to take up a challenge with a 95% chance of being punished for it? It is important to determine the true cause of the failure. Was it the unsuccessful implementation of a project which was initially a great idea, or maybe the lack of market acceptance even though the team have done a good job? Before he came up with a light bulb, Thomas Edison had discovered 99 ways how not to make a light bulb. Innovativeness is the right to fail, with victories outweighing the failures.

[30] The obstacles encountered by our minds when facing risk and other phenomena are described by D. Kahneman in *Pułapki Myślenia. O myśleniu szybkim i wolnym (Thinking. Fast and slow)*, Media Rodzina, 2012

[31] A. Skala, E. Kruczkowska, M. A. Olczak, *Polskie Start-upy. Raport 2015 (Polish Start-ups. Report 2015)*, the Start-up Poland Foundation, Warsaw, 2015

## Innovation portfolio: It takes n-number of trials to find a successful project.

*A supermarket chain turned its back on Mr Inventive's idea saying it's too risky (and if it proves to be a success, it could result in market cannibalism). But is this really Mr Inventive's problem?*

A single innovative project has little chance of success. But low probability of success did not deter Thomas Edison from building dozens of light bulb prototypes. The great inventor's approach well illustrates the practical truth about innovations: the pursuit of innovation gives satisfactory results only in a portfolio of projects. Although a successful innovation achieved as an independent project is a stroke of luck, the advantage of a portfolio of projects is that it can be managed. A properly built portfolio gives a nearly 100% chance of success. The only question is how long it will take and at what cost. Let us assume that the odds of a successful innovative project are 16%, which is like throwing a die. In six cases out of six, when we want to finance our projects in the so called first round, we are bound to incur expenditure on development of the idea, R&D work and designing prototypes. Such expenditure is our risk. Only one project out of six will develop as expected to bring a profit. If we wish to throw a six, we should get an entire set of dice. However, contrary to an intuitive answer, there must be more than six dice. For a six to be thrown with a probability of 95% we need as many as 17 dice! If we think that 17 innovative projects will take up too much of our management efforts and we would like to reduce the portfolio to nine projects, the probability of success will drop to 80%, with eight projects most likely to come to nothing. If we believe in the golden rule of three and muster three projects, our chances of success will stand at 42%.

This is a management problem, typically faced by companies with ambitions to develop their innovative ideas. The point here is that if we build a portfolio comprising a small number of innovative projects, we settle for a compromise: we either limit the portfolio's chance of success or reduce the risk of the pursued projects. In practice this means implementation of incremental activities focused on cost optimisation. On the other hand, if we embark on a large portfolio of innovative projects, we use much more resources. Some of them will involve direct investments in the projects at hand; but if there are many projects, they will require a team of managers and much attention, resulting in fixed costs. Fixed costs mean lower flexibility and higher risk.

What adds complexity is that projects have their critical mass – a revolutionary solution may (still) be developed in mobile applications by a team of several people working on a piece of paper, but in capital intensive power engineering testing new solutions means heavy expenditure and several years of work of a large team. And financing comes in more than just a single round...

### CONCLUSIONS

Building a successful portfolio of innovative projects requires:

- centralised approach to managing risks inherent in innovative projects based on portfolio management, with decision-making powers and project execution tasks delegated to lower management levels,
- use of a wide range of organisational measures to increase the portfolio's initial low probability of success.

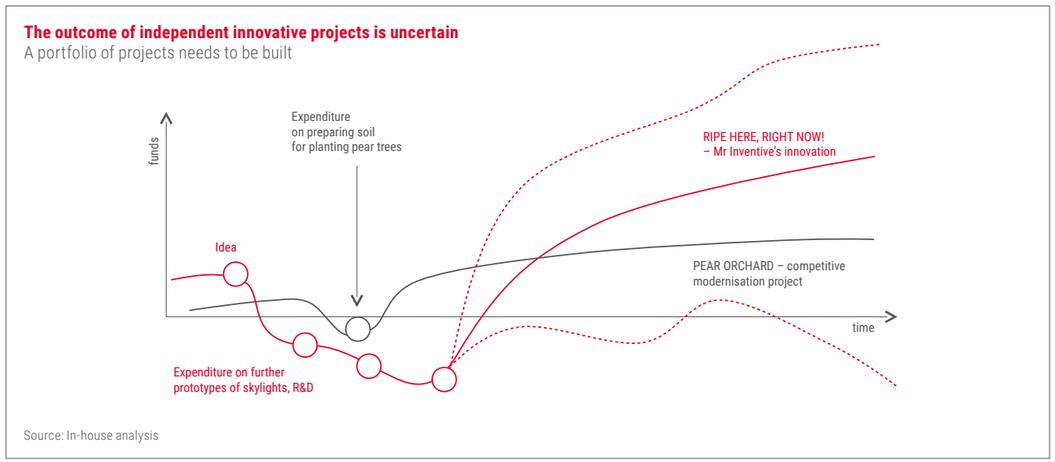



Figure 18. Financial curve of a modernisation project and an innovation project





## How many independent projects does it take for a portfolio to be successful?

The desired size of a portfolio of projects may be estimated based on two parameters – the chance of success of an individual project specific to a given company and the industry, and the management's desired level of certainty about the success of the entire portfolio.

Projects build a well-diversified portfolio when they are independent. If two or three projects represent a similar trend, they cannot be considered independent – and then the portfolio must be even bigger.

| | | What is the desired level of certainty of the portfolio's success? | | |
|---|---|---|---|---|
| | | 50% | 70% | 90% |
| chance of success of an individual project | 1 in 4 | 3 | 5 | 8 |
| | 1 in 7 | 5 | 8 | 15 |
| | 1 in 10 | 7 | 12 | 22 |

Source: In-house analysis

Table 1. Probability of success of a portfolio of innovative projects depending on the chance of success of individual projects.

## How to increase the effectiveness of a portfolio of innovative projects?

There are a number of ways to increase the effectiveness of a project portfolio:

- **Concentrate innovation management in a single decision-making centre within the company** – managing the portfolio risk requires a centralised approach, as did the selection of projects to the portfolio. A diversified portfolio (in which the chances of success of two projects are independent of each other) is obviously smaller and less costly than a portfolio including twin projects.
- **Adopt a stage-gate procedure**. What is measured is the success of the entire portfolio, so if some projects fail, this does not mean the failure of the portfolio.
- **Improve selection of companies to be included in the portfolio** to build 'mission-oriented portfolios'.
- **Do not treat outcomes of individual projects as a measure of success**. This way of thinking is a trap.
- **Eliminate unpromising projects based on clear and consistent criteria**. Avoid discretionary extension of project life and keeping projects going only because of the expenditure incurred.
- **Make company's resources available to innovators** (in the form of a network of contacts, access to technical and marketing specialists, laboratories and sales network) – to shorten the testing stage, to take the project as close to real life as possible, and to accelerate the scaling of the project.
- **Stimulate innovators, e.g. by helping them in their search for alternative technology applications and by creating an environment conducive to exchanging ideas** – the objective is not only to boost innovators' confidence but also to increase the likelihood of the innovation being successfully monetized!

## A cloistered university and a passive business miss a cooperation channel where the business would take the driving seat.

*When Mr Inventive contacts a university, which is the third key party to the innovation process (next to a startup and a corporation), he is told to turn to the project commercialisation centre. This is where he meets Tola, who is very glad that Mr Inventive wants to start cooperation in the area of R&D. Mr Inventive explains that he would like to open an innovative greengrocery – 'Ripe Here, Ripe Now!', and use a modified method of work with greenhouse skylights that he has seen elsewhere. Tola knows that a tranche of grants for skylight research has been recently allocated and shares the information with Mr Inventive.*

*Mr Inventive fills out three forms and is free to leave. 'It's better than six forms a few years ago,' he thinks. 'And I'll get a subsidy!' he reflects, clearly satisfied.*

*After two weeks which public institutions have to process applications, he is invited to a meeting with faculty members. When he gets back to the university he meets Dr. Friendly, from the Department of Roof Windows.*

**The best Polish university secures approximately PLN 380m for its research and development work** – it is a significant progress compared with the previous decade, though it is still eight time less than the annual income from research activities of Harvard University, one of the top universities in the United States. What is more, the number of students at Harvard represent only one-third of the number of students at the Polish university.[32] 25% of Harvard's income from research activities is not related to government funding. To illustrate the difference it is worth noting that the number of Polish companies actively involved in research activities is approximately 3,100, of which 40% also outsource such activities.[33] Of those 40%, one in six companies commissions the Polish Academy of Sciences and other academic institutions to perform the research activities. This gives approximately 200 companies. Government grants will not be sufficient to close such a large financing gap in the economy. For example, the grant for a research consortium operating as part of the KNOW programme covering National Scientific Lead Centres is PLN 10m per year.[34] Improving cooperation between universities and businesses is necessary, because according to the Global Competitiveness Report Poland is ranked 73rd out of 140 analysed countries, which is unproportionally low compared with GDP-based rankings.[35] As long as economic progress was driven by simple elimination of ineffectiveness and by technology upgrades, the economy could grow at a robust pace, irrespective of the amount of R&D spending, which was redundant in this model. It does not work like this in an innovative economy.

**As this issue has been addressed in various reports, we would like to present PKN ORLEN's experience in this respect, gained in our domestic shale gas projects**. Two problems emerged in their course. Firstly, the format of cooperation with universities is not adjusted to the way businesses operate. Secondly, support programmes impose artificial requirements, which make cooperation in the already complex area of intellectual property even more difficult.

**To begin with, universities' approach to risk is contrary to how businesses perceive risk**. Where companies would like to put a low price on IP, as they are aware that roughly 90% of projects fail, universities would like IP to have a high price to avoid being accused of mismanagement if a given project turns out to be a success.[36]

**If such different approaches to risk are not to become a barrier preventing cooperation, it is necessary to find a new form of working together** that would keep research activities attractive to academic researchers while leaving the initiative with businesses.

### CONCLUSIONS

Cooperation on innovative projects between universities and businesses may be improved by:

- enhanced mechanisms of cooperation on innovative projects, with the support of EU funds;
- transferring initiative to innovate to businesses, at least in specific areas, which may help change the approach to project implementation where priority is given to technology development instead of innovation.

[32] University of Warsaw, *Fakty i liczby (Facts and figures)*, www.uw.edu.pl, viewed May 10th 2016; Harvard University, *Fact Book*, www.oir.harvard.edu, viewed May 10th 2016
[33] GUS, *Działalność badawcza i rozwojowa w Polsce w 2013 r. (R&D activities in Poland in 2013)*, Warsaw, 2014
[34] Ministry of Science and Higher Education, *Ruszył konkurs na Krajowe Naukowe Ośrodki Wiodące (National Scientific Lead Centres competition began)*, September 16th 2013, www.nauka.gov.pl
[35] K. Schwab, *The Global Competitiveness Report 2015–2016*, World Economic Forum, www.weforum.org, Geneva, 2015
[36] Z. Grajkowski, *Bariery rozwoju innowacji w Polsce (Barriers to innovation growth in Poland)*, GIZA Polish Ventures, Warsaw, 2012, www.gpventures.pl





## How to adjust innovation and R&D work to the needs of customers? The case of shale gas

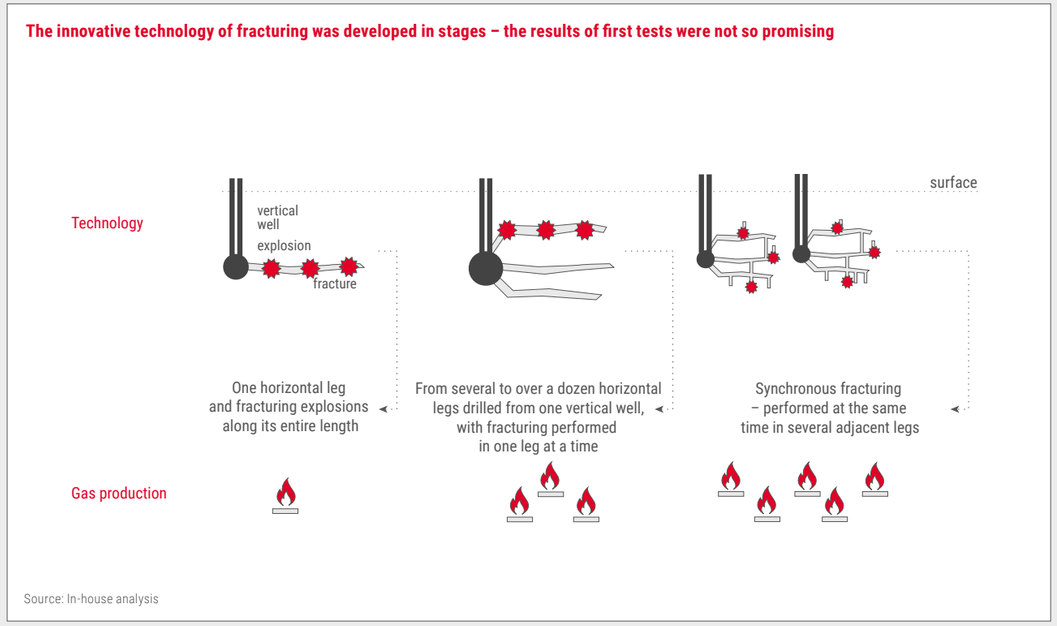



Figure 19. Evolution of fracturing methods reflecting development of the technology

One of the areas offering room for potential innovations in Poland is shale gas production. It requires solid foundations in the form of research, which is what we are short of in our geological conditions.

The shale boom in the United States grew from the theory of fractures, which works perfectly in rigid material such as steel and rock. The technology developed based on that theory, with the use of appropriate models, is adjusted to the geological conditions found in the United States, where it proved successful. However, it is wrongly believed that, once invented, the shale gas production technology is final. In fact, it is continuously adjusted to various specific geological structures.

The theory of fractures does not apply to soft material, e.g. clay. Thus, it did not prove effective in the geological formations found in Poland. The solution to the problem of Polish shales requires a different theory, analogous to the theory of fractures. A theoretical knowledge how to produce gas from clay formations will help design machines for such gas production. Thus, we have a key research area and an objective for technology implementation.

The Blue Gas project in Poland was designed to provide access to shale gas. Its failure resulted from resorting only to Polish sources of knowledge and focusing on technologies which were already being developed at the time the research was commissioned. A natural course of action was to find common elements between the research carried out at the time and the project. The needs of customers were insufficiently reflected in the research and, as a result, no appropriate technology was developed.

In projects such as Blue Gas the innovation initiative should rest with businesses as it's them who know the customers' needs. Even if projects are financed by the state as the ultimate beneficiary of the mission to stimulate the economy, entrepreneurs should point the direction of work as part of the 'pull' system.

## How to protect intellectual property (IP) in projects funded from external sources?

**Cutting the red tape around state aid has been identified by 70% of businesses as the basic form of support for their R&D projects**.[37]

Companies determined to create innovations using EU funding are often required to apply the rule of competition in the award of contracts to subcontractors, which may be a dead end in the case of R&D projects. Limitations on the outsourcing of all research work reduce the role of universities in such projects. Moreover, if subcontracting costs exceed the threshold of EUR 209,000, a relevant notice must be published in the Official Journal of the European Union.

Research work may be contracted through public tenders, but also outside the procedure. A public tender entails:

- less control over the selection of a contractor for research work,
- publication of sensitive information included in the project,
- slower progress of work and more formalities (for instance, a request for proposal must be published in the Official Journal of the European Union for a period of 40 days).

Award of contract to a subcontractor outside the public tender procedure is more intuitive. However, in that scenario the new technology will not be at the investor's sole disposal – benefits must be shared with the subcontractor (for instance, the right to develop the technology). In that case, an investor who decides to take a plunge and invest in an innovative project will have no guarantee of exclusive rights to the assets in which he has invested! This applies especially to the exemption referred to in Art. 4.3.e of the Public Procurement Law.

Furthermore, in the case of projects implemented as part of a consortium, the leader is fully responsible for its implementation, even though the benefits are shared by all consortium members.

[37] KPMG, *Działalność badawczo-rozwojowa przedsiębiorstw w Polsce. Perspektywa 2020 (R&D activities of companies in Poland. Perspective 2020)*, Warsaw, 2013, www.kpmg.com





## If we decide to hand over the initiative to the business, we reduce the risk of mistaking a new technology with innovation.

**Ignacy Łukasiewicz's invention, the then-innovative kerosene lamp, wouldn't have brought any profits if it hadn't been for a night-time surgery in Lviv where more light was needed at the hospital bed**. Lighting the surgery with oil wouldn't have evolved into a repetitive business model if it hadn't been for the available, stable supply of oil as a fuel – which was possible thanks to the distillation technology modified by Łukasiewicz. Technology was a substrate of the invention, but if there had been no need, the discovery would have never evolved into innovation.

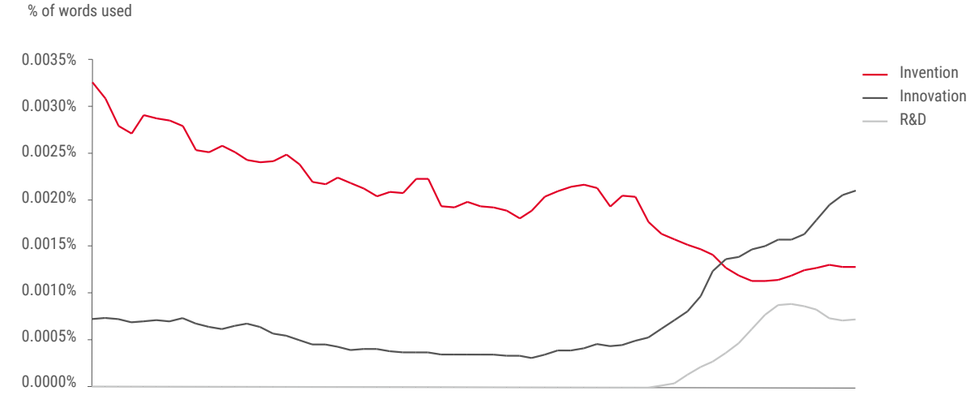
**Invention and innovation are two different notions. Innovation does not need to include new technologies**. A portable audio cassette player, which undoubtedly was an innovation, did not include any new technology. It was developed by marketing specialists who thought that people would like the idea of listening to music while on the move. A PC had a similar story. Somebody came up with an idea that such functionalities could be of use and assembled a device which included selected functions made from generally available components. As Steve Jobs once said: first you need to identify innovation, and then build it using available elements.

Innovation does not need to go hand in hand with inventions, new technologies or even R&D, which becomes clear if we look at the statistics on the number of words appearing in Google Ngram Viewer publications.

**Entrepreneurship is the horse, and innovation is the cart. In putting innovation ahead of entrepreneurship, our thinking has been dangerously off. It doesn't matter how brilliant the innovative idea is if there's no one to create a business that sells it. (...) Innovation, discovery, breakthroughs, ideas and creativity are valuable and necessary – we can't get enough of them. But they create little to no economic energy in and of themselves until an almighty customer appears. The car, the light bulb, flight, the transistor and the Internet created little to no economic energy until each invention was successfully commercialized – until customers appeared.**[38]

Jim Clifton, CEO of Gallup

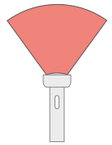
**Only at the turn of 1960s and 1970s did the word 'innovation' replace the word 'invention' as the key vehicle of development**
Example: words innovation, invention, R&D




Source: In-house analysis based on Google Ngram Viewer

Figure 20. Frequency of occurrence of selected words in published texts

[38] Gallup, *Innovation Has No Value Without Entrepreneurship*, January 8th 2016, www.gallup.com, viewed May 9th 2016



# How can we translate innovation into the added value chain in Poland?

## Who else, if not the government and businesses, will help to scale up an innovative project?

*Undeterred, Mr Inventive turns to the market. Venture capitalists declare they would finance his project only in stage two, when Mr Inventive's 'Ripe Here, Ripe Now!' business reaches a revenue of PLN 2m, or PLN 1m per store.*

*Neither did Mr Inventive find any external agencies such as business accelerators which would network the young company with food technology specialists or help create a sales network to upscale the project faster and thus reduce project-related risks.*

**Have you ever wondered why there is only one Silicon Valley?** Do you know that Silicon Valley was built based on the US Army and DARPA orders, and the 'building blocks' used in today's consumer electronics were developed thanks to government funding, since the business sector failed to identify their potential and did not expect that such solutions could even exist?[39]

**Innovations targeted at end consumers are usually a combination of 'building blocks' developed for an entirely different purpose – for instance, for the army**. The state has a role to play in the development of technologies which may find a more universal application in the economy, but it should not take over the role of entrepreneurs – that is to reach end consumers with products developed with those technologies.

**The Polish economy has made enormous progress, considering that the links between the business and scientific communities are rather weak**. In the initial phase of Poland's transformation, those links were not even needed. The economy was teeming with inefficiencies which had to be eliminated, step by step, in order to boost productivity. In the meantime, the economy was thoroughly modernized, based on foreign direct investments and acquisition of state-of-the-art, well-tested solutions. At that stage, it seemed that Polish science was of no use for the business – after all, you could buy any technology, if needed. The effects of our country's economic transformation and modernization are impressive in terms of the rate of growth of national and household incomes. Poland ranks 40th in the world in terms of GDP per capita.[40]

**However, this exclusive reliance on advanced foreign technologies has its opportunity cost**; in our case, it is the absence of links between science and business, and a huge gap in R&D. Poland currently ranks 73rd in terms of the scale of collaboration between business and science. As a result, we do not have domestic precision industry

[39] M. Mazzucato, *The entrepreneurial state*, Anthem Press, London, 2013

[40] Excluding all economies of less than 1 million inhabitants, GDP in USD, not weighted by purchasing power parity. See The World Bank, *World Development Indicators*, www.databank.worldbank.org, viewed May 10th 2016





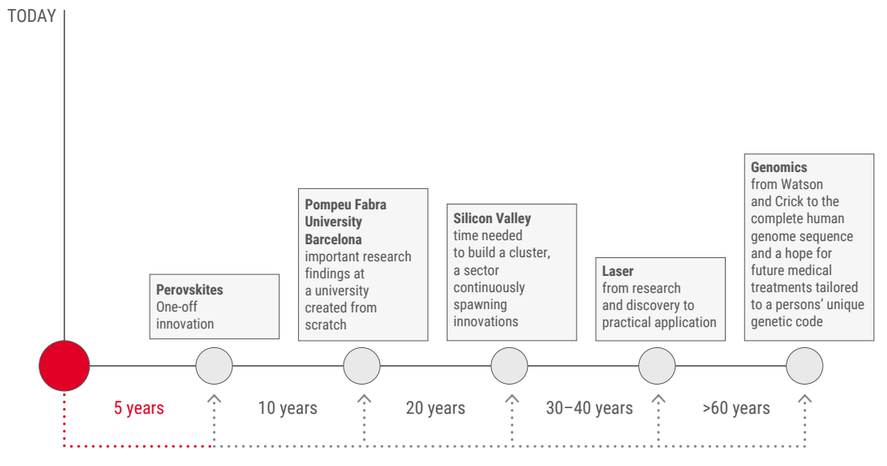
(labs) to make single items of unique machinery or equipment that businesses need to test new technologies. Such an industry will never develop if nobody orders the products, and having it in the economic system would not only guarantee stable and well-paid jobs but, most importantly, would be one of the key elements of innovation scaling.

**Breakthrough innovations have a long-term impact, which lasts several decades and involves challenges such as developing and maintaining a complete end-to-end value chain in the country**. It is the ultimate goal, and few countries have actually succeeded in achieving it. On the other hand, it should be noted that one may get involved in the creation of technological progress at any point. From the perspective of economic benefits (development of precision industry which will generate brand new equipment and permanent well-paid jobs) it is important to keep in the country at least those links of the value chain which lead from the prototype to commercialisation.

**We are all miners, and ORLEN as an upstream company is the first to see it**. Importing advanced processing technologies from abroad is becoming more difficult and expensive, as productivity-enhancing solutions are drawing close to the global technological limit, and as such are not readily traded by their owners. Shale gas production technology is a good example. You can buy the equipment (drilling rigs, fracturing equipment), you can hire experienced drilling staff, but the know-how is not for sale. In this case, know-how is soft knowledge on how to combine different links into one network to mobilise the rock and extract hydrocarbons. Moving up to economy as a whole, innovation is a method (model) of its functioning, which is based on effective coordination of activities undertaken by various stakeholders (partners), including: individuals (authors, scientists, researchers, entrepreneurs), universities, companies at various maturity levels (from start-ups to corporations), as well as institutions (public and private). The model of partnership-based collaboration in innovative projects may be fine-tuned based solely on market mechanisms. If this is the case, it may take a long time to build foundations for an innovative European economy, and ultimately it may lead to failure. If we want our efforts to have meaningful results faster, it may be worthwhile to find a leader at a governmental or parliamentary level (such as SITRA in Finland).

**Such leadership is needed, particularly in light of the amount of energy spent in Poland on providing support for young innovation projects.** We also revamp our universities and make efforts to promote entrepreneurial ecosystems. Governmental aid programmes coordinated by the National Centre for Research and Development end at

**Breakthrough innovations have a long-term impact, which lasts several decades.**
**It is more difficult to maintain the 'ownership' of their effects,**
but the interest in innovation and R&D projects is growing




Source: In-house analysis

Figure 21. Time needed to generate innovation

the prototype stage, and in a few years' time we can expect the opening of the 'prototype floodgate'. But who will take up the baton and buy those prototypes? By default, it should be the business sector – Polish businesses with enough money at their disposal to swallow the cost of an unsuccessful investment in further prototype development. And the odds are against investors. Large Polish companies are few and far between and we can expect that they may be interested in innovative prototypes which will fit within their strategies, provided that they are well prepared. This is more likely than the reverse process, namely developing a strategy for a risky prototype which does not fit in the company's business or interests. But what are the odds that several promising prototypes funded with public money will fit perfectly within the strategies of several Polish companies?

Polish innovations would stand a better chance if all stakeholders – from researchers and potential prototype developers to businesses and the government – knew the long-term priorities of the country's social and economic development in advance. Let's assume that one of those priorities is related to a low-emission economy, and is planned to take several decades. The plan is to use the country's coal resources to the benefit of Polish economy in the least emission-intensive manner, but without imposing any specific methods. The government has announced that priority and earmarked certain funds for the financing of innovative projects across all stages: from basic research, through prototype and scaling, to commercialisation. However, there are two conditions to be met. First of all, coal must be used somehow; and secondly, all projects must be implemented in the Silesian Region. What are the outcomes of such an approach? A priority will act like a magnetic field, arranging the efforts made by formally unrelated stakeholders towards a set goal. As a result, we stand a better chance that different links of the value chain developed at a different time and at a different stage of completion will ultimately fit together.

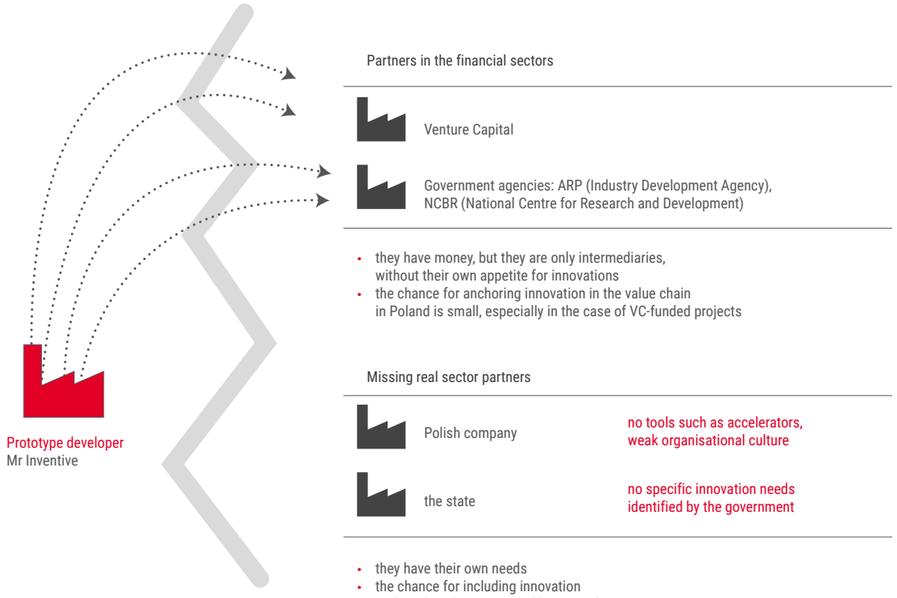
**The lack of fit between parts of the value chain manifests itself in the most fundamental and pressing problem in the Polish game of innovation** – namely the lack of customers for innovative prototypes developed by start-ups who would be willing to take over the riskiest part of the project. Prototypes are currently developed through venture capital funds or governmental funding institutions; and they are both focusing on financial activity. We believe that innovation is an answer to certain needs, and stakeholders such as the industry or the state, which are closer to end users, have better access to customer needs than intermediaries. However, both the industry and the state are dysfunctional: the industry has no tools to take over prototypes for development, and the state has not defined its needs, which means that it does not create the demand for innovations. The state and the industry should coordinate their work, and there is also extra room for the contribution from universities.

**There is no prototype market in Poland. Specifically, there are no entities willing to take a plunge and invest their capital and efforts into the riskiest part of a project.**

The most telling example are perovskites, or the methods for producing photovoltaic cells developed by Olga Malinkiewicz, winner of PKN ORLEN's 'Poles with Verve' ('Polacy z werwą') competition. Polish corporations asked to provide support for further development of that innovative project understood the need, but were not interested in getting actively involved. Instead, a foreign partner came into play.

In Poland, early-stage support for innovations is at a relatively good level. NCBR takes initial ideas to the working prototype stage and provides funding for feasibility study, proof-of-principle, and proof-of-concept work. Thanks to NCBR's initiatives, such as the BRIdge Alfa programme, it is increasingly easier to secure financing for developing an innovative idea in Poland. The network of NGOs providing support for fledgling innovation projects, such as AIP (Academic Business Incubators), is also relatively well developed. True, project outcome is highly uncertain at the seed stage, but the cost of taking risk is rather low given the limited engagement of own capital.

**Author of a prototype must cross the financial 'Death Valley', but the government and businesses are often unable to support him**




Source: In-house analysis.

Figure 22. Partnership agreements moving innovation from the prototype level to the scaling stage





However, the next stage (project development) is more difficult, with higher risks and still no profits in sight, plus a much higher investment. Due to the asymmetry of information between the innovator and the financing party, the greatest challenge is to secure funding and technical support. The innovator knows his own idea very well, but for the financing party he will always be only one of potential business partners, offering a project which is difficult to benchmark. In the language of start-ups, this phase has a special name: the Death Valley. At that point, a potential innovator must choose a partner with whom to go ahead with the project.

**So who will scale the prototype? First of all, we should look at large-scale businesses**. Forty-five per cent of innovations in the industrial sector are rolled out by companies with a headcount of more than 250 employees, because they are driven by commercial considerations. The state will cater to the basic needs of security on behalf of its citizens. Inclusion of Polish businesses and the state in the group of partners should be our priority if we want to put the focus not only on the 'welfare of giraffes' (that is, innovators), whose ideas will be funded with public grants, but also on the impact of innovations on the value chain and jobs in Poland. Global market launch of the final product brings the highest profits, but increased efficiency in the commodity sector, supported by innovations, can also bring benefits; in the latter case, gasoline or coal are global products, and innovations are translated into a global competitive advantage.

Although stand-alone venture capital funds are flexible and may offer certain functional support to commercialize innovative solutions (such as branding or access to technical expertise), the key competitive edge of businesses and the state as innovators lies in their own appetite for innovation and the possibility to anchor innovative solutions in the country's industry. Necessity is the mother of innovation - just as in the case of Ignacy Łukasiewicz's invention.

**If we don't learn to tap the opportunities offered by prototypes, ideas generated in the seed phase with the support of state aid will be commercialized, but outside of Poland**. There is an anecdote: a US venture capital that goes to the UK for shopping to buy prototypes at 55% of their price in the US, but it can also go to Poland to buy them at 5% of the price. Do we really want to finance the growth of more developed economies?

**The second problem, which could be solved over the next 10-20 years, is the education of staff competent to perform innovative work** – especially to spawn new ideas and implement them based on teamwork. The shortage of funding experienced by Polish innovators is discussed at length in the first part of our report. However, the current lack of demand for prototypes in the real economy hides the truth: namely, a small number and low quality of innovative ideas. When it comes to internal generation of ideas, the experience of Polish companies (often confirmed at various conferences) shows that in the 'recruitment' phase ideas tend to be rather run-of-the-mill. When we close the life cycle of innovative projects by ensuring that prototypes are taken over for development, the shortage of ideas will become fully visible. The number of ideas will depend on how good Polish graduates are, because you can't force people to be creative. Therefore, we need to work at the grassroots level.

## Seed financing is becoming more available. NCBR is working on the BRIdge Alfa programme

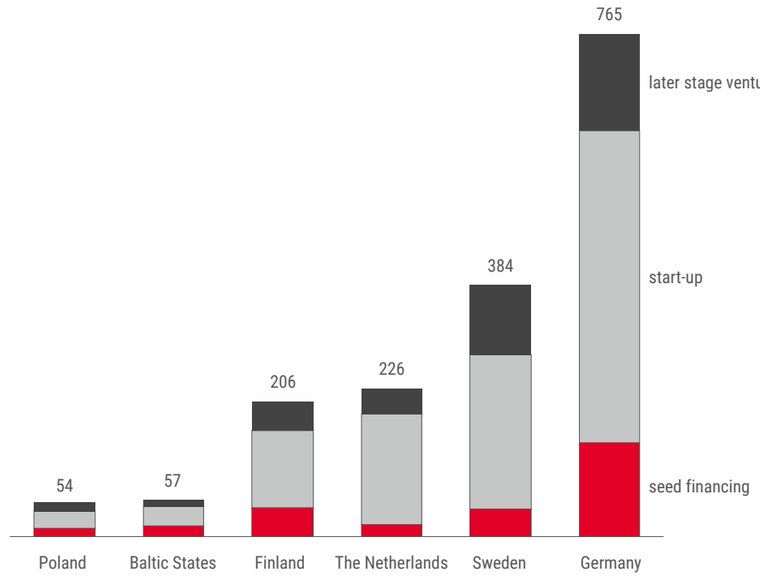
The program is designed to test projects at the proof-of-principle and proof-of-concept levels. With the minimum 20% capital involvement, an investor interested in innovations may establish a PLN 5-20m innovation vehicle with NCBR.

NCBR's approach is based on modern assumptions:

- the concept is based on the American SBIR project (Small Business Innovation Research) and its Israeli equivalents,
- financing through special purpose vehicles which collaborate with project initiators.

**Adjustments needed?** NCBR procedures still impose excessive burden on businesses, and the scientific side is over-represented in the decision-making bodies which grant the financing.

**In Poland, the number of companies using venture capital financing is four times lower than in Finland or the Netherlands**
number




Source: In-house analysis based on EVCA, *Yearbook2015*, investeurope.eu

Figure 23. Number of companies using financial aid



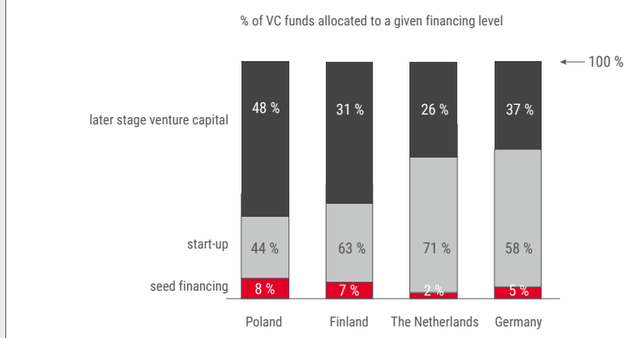


## Most venture capital funds are ready and willing to finance the seed and expansion phases, but definitely less eager to get involved in the intermediate high-risk phase.

Such funds are ready to accept only part of increased risk inherent in innovative projects, but not total uncertainty:

- the market of seed-phase ideas is still too small, which makes it difficult for VC funds to build their portfolios,[41]
- with few exceptions, even the VC funds which enjoy the support of the National Capital Fund have adopted a cautious approach,
- the NewConnect capitalisation is on the rise, but the number and value of IPOs does not follow the same trend line; NewConnect is neither a source of capital for start-ups nor the 'exit market' for venture capital funds, which increases operational risks for the funds.

**In Poland, later-stage financial aid prevails**
In Germany and the Netherlands, start-ups are supported in the seed phase

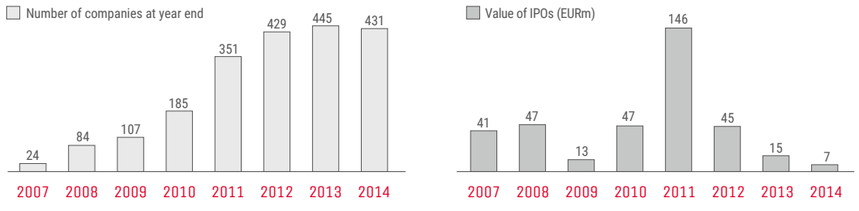



Source: In-house analysis based on EVCA, *Yearbook2015*, investeurope.eu

Figure 24. Project financing provided by venture capital funds

**NewConnect as the alternative market has developed dynamically**
number of companies at year end

**Decline in the value of IPOs after 2011 limits the role of the stock exchange as the exit market for venture capital funds**
value of IPOs, EURm




Warsaw Stock Exchange, *Raport o rynku NewConnect 2015 rok (Report on the NewConnect market in 2015)*, GPW, May 2015

Figure 25. NewConnect alternative market

[41] Z. Grajkowski, *Bariery rozwoju innowacji w Polsce (Barriers to innovation growth in Poland)*, GIZA Polish Ventures, Warsaw 2012, www.gpventures.pl

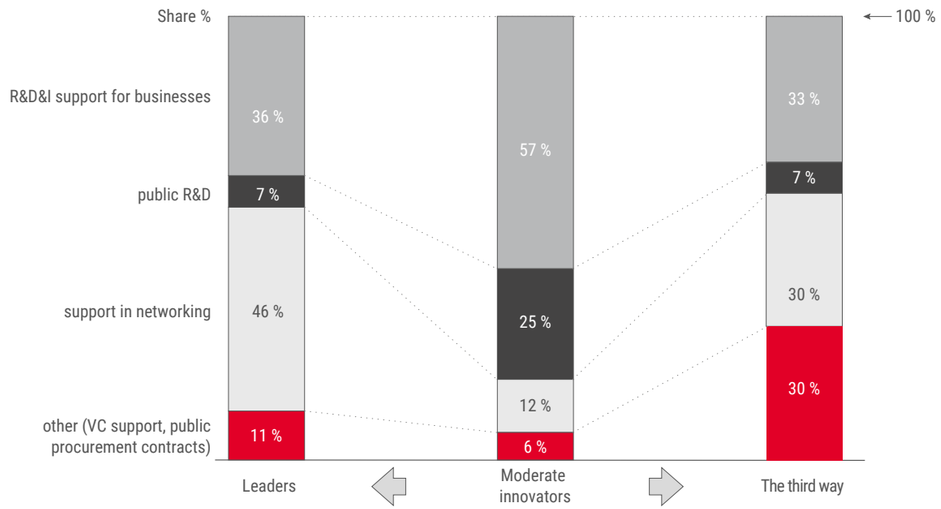
## Mind the state: Its development mission is to trigger innovations oriented towards real public needs

**The true objective of innovation is to maximise benefits for the public. To meet this objective, the state's innovation mission** must be developed and must complement its economic mission. This is a necessary condition for innovative projects to produce such benefits as secure jobs and the anchoring of possibly the largest part of the added value chain in Poland.

**The innovation mission will be best targeted if it answers the needs of the state as an entity**. Therefore, we are referring to the need for security – energy security, protection of health, food security, and the defence capacity of the state. However, we believe that from the point of view of innovation, these priorities should not take the form of a list of sectoral policies. Neither should the state fill in for companies where their role is to identify the needs of an end user.

**The innovation mission should have a manager. We believe a good solution would be to create an innovation broker modelled on the American DARPA** – an agency whose mission is to encourage innovation in four areas representing the country's strategic priorities, which enjoys substantial autonomy and, as far as possible, follows a technologically neutral approach. What we mean is the role of a facilitator organising a network of partners involved in specific projects, as well as dynamic allocation of support and financing of innovative initiatives. Knowing the way administration institutions operate and the degree of reluctance to take risk in Poland, we can think of three or four priorities within which development projects with risk profiles typical of innovative ventures will be implemented.

**Should we seek to catch up with the best or choose our own direction? Which way should Poland go?**




Source: In-house analysis based on R. Veugelers, *Mixing And Matching Research and Innovation Policies In EU Countries*, Bruegel Working Paper 2015/16, www.bruegel.org

Figure 26. Allocation of budgets to research and innovation support in Europe





With this upper limit in mind, we have identified the four areas of security for which the state would be the most credible partner. We believe the innovation broker should be situated somewhere between the objectives of the Industrial Development Agency (ARP) and the National Centre for Research and Development (NCBR), rather than the Industrial Development Agency, the Polish Agency for Enterprise Development (PARP) and Poland's development bank – BGK, which to date have been responsible for selected aspects of innovation. It should be noted that the presence of strong external entities acting as catalysts in the innovation process is also a part of the Finnish experience – the VTT Technical Research Centre of Finland takes part in about 30 national technological programmes and contributes its expertise to some 36% of innovations developed in that country. It operates in parallel with a financing institution, TEKES.

**For development projects to be successful and yield the expected innovation effects, their starting point should be existing *needs* rather than a *technological objective*.** Why? Because 'picking dark horses' in the innovation market is illusory. Firstly, the benefits of innovation and knowledge created through an innovation process often materialise in a different area than planned. Secondly, a technology that is highly popular now, tomorrow may reach the 'trough of disillusionment', while the need will continue. If we think about the need to protect the health of farm animals, perhaps the best answer would be a modified fodder and not a drone.

**The innovation broker should thus focus on forming innovation networks** and have a capacity to finance a large number of relatively small initiatives.

**The economic mission is an attempt to present a possible Polish way to innovation**. When thinking about the development of an innovation system, it would be prudent to avoid the sin of procuring a system that is to produce original and unique solutions by copying it from another economy. While it is useful to benefit from the experience of the masters, the more we are tempted to venture into the sphere of breakthrough innovations, the bigger the advantages of having an internally developed system.

It is good to have an opportunity to learn from the world's and Europe's leaders. One source of practical guidance is Israel, with its excellent innovation ecosystem whose strength lies in the cooperation of start-ups with the financial sector and defence industry. Today Israel calls itself a 'start-up nation', and spends 4.25% of its GDP on research and development. South Korea successfully involved large companies in the innovation mechanism and travelled the path from modernisation to innovation in the sphere of collaborative partnership of business and science. Finland has created a great institutional framework for innovation processes, consisting of governmental agencies. Taking into account the Polish situation, it would also be good to identify solutions suited to the specific nature of our economy, such as an innovation-oriented procurement policy in the public sector.

## CONCLUSIONS

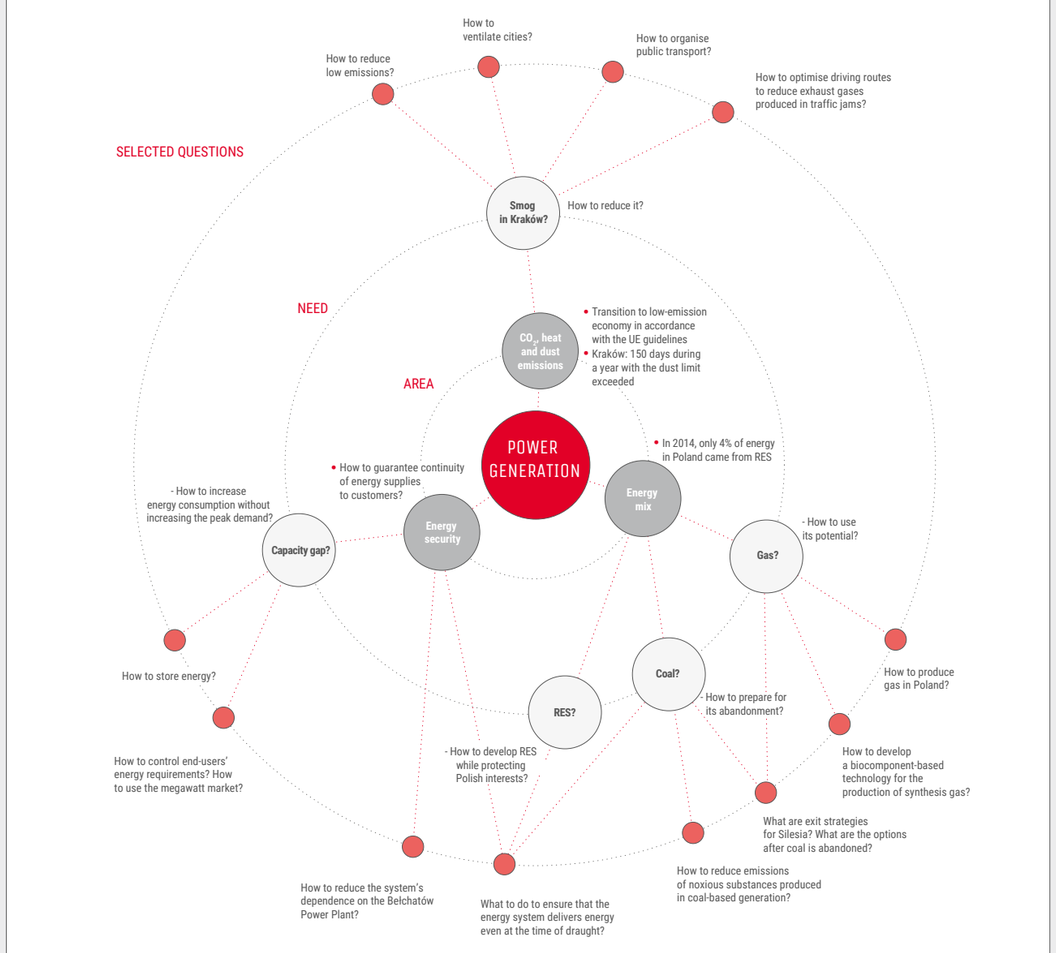
**We suggest the following measures to effectively use the potential of the innovation mission of the state:**

- **placing the four areas of security** which can be directly influenced by the state **in the centre of the state's innovation mission**;
- **establishing an institution that will act as an innovation broker** and will oversee the whole innovation process, from the moment the idea is conceived to the moment it is incorporated into the national value chain; any interventions should be on a selective rather than a systematic basis;
- **ensuring the economic priorities set for the innovation broker are oriented towards existing needs (security) rather than specific technologies**; in the case of innovative projects, it would be risky to follow a mental shortcut where an objective is defined but the need as a pre-condition for defining an objective is eliminated, as this is tantamount to picking 'dark horses' (for example, we consider the development of a full range of Polish drones provided for in the 'Responsible Development Plan' as a technological direction and not a need);
- **equipping the innovation broker with capabilities to handle a larger number of smaller projects** with a higher risk profile rather than a small number of more cautious initiatives carrying a lower risk.

## Questions and needs for the development mission – POWER GENERATION

**The long-term nature of power generation projects implies other requirements for the organisational structuring of innovation networks than Internet applications with implementation periods of two-three years.** However, the key question is similar: is it possible to formulate questions that are relevant primarily to Poland but can potentially attract interest from the rest of the world, that is scalable ones?

Selected examples



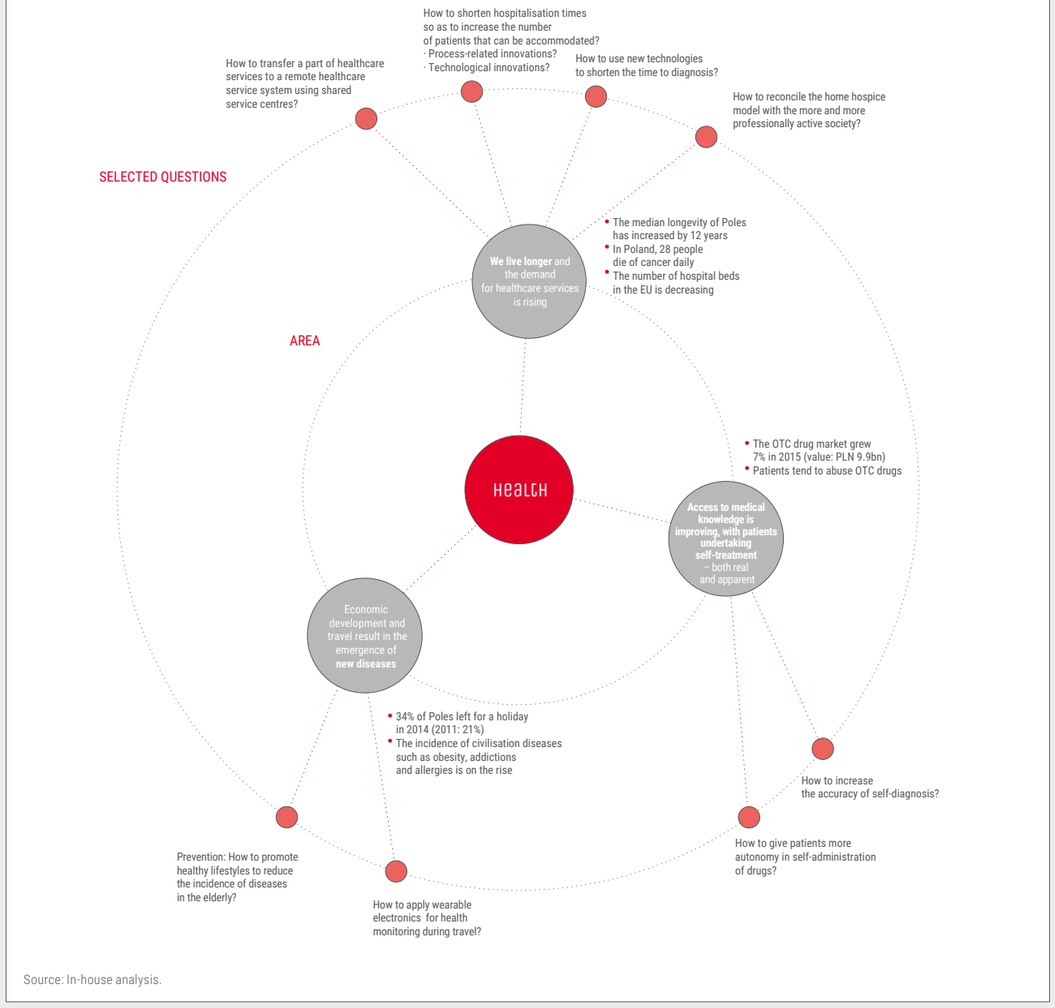

Source: In-house analysis.

Figure 27. Challenges for the energy sector

## Selected questions and needs for the development mission – HEALTH

**A distinguishing feature of innovation in the area of health is the necessity to find solutions that reconcile respect for the physician's work conditions with respect for the patient's dignity.** Some examples of areas where security needs are identified with respect to health, and potential innovation competitions for an innovation broker are presented in the graph below.

Selected examples




Source: In-house analysis.

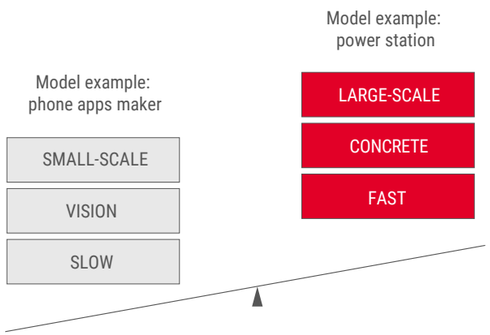
Figure 28. Challenges for the healthcare industry

## A national broker modelled on DARPA, creating ad-hoc innovation networks, would be well suited for carrying out the economy's 'development mission'

**An innovation broker is:**

- **Animator of the innovative sphere autonomous from academic institutions. Focused on innovations likely to become a vital part of the fabric of Polish economy** throughout their life cycle, from supporting business incubators, to providing grants for basic, use-driven and applied research, to lobbying corporations for the creation of joint thematic accelerators.
- **Business and scientific organisation consisting of four working groups, dedicated to 'economic missions'** corresponding to different security needs: in energy, health, defence, and food. Oriented toward breaking new ground, rather than all-encompassing research work in a field;
- **Developer of ad-hoc innovation networks and moderator ('broker') in academia-business relations.** Networks would generally be formed on an ad hoc rather than permanent basis, to work on a specific project or programme. Permanent networks would require an assumption that innovation will happen between permanent network participants, with the risk of missing out on good ideas out there. The broker's role would be to acquire the best ideas regardless of their source. As for permanent networks, there is a risk that customers would not be interested in buying technologies developed by predefined vendors. Exchange in such cases would need to be artificially induced by the broker.
- **Centre supporting prototype scaling to address strategic needs of the state** (supporting transformation of prototypes into industrial projects).
- **Agency actively managing funds in pursuit of its 'development mission'**, instead of being focused on 'development of a specific academic institution'. Manager of state funds within no more than three to four defined, priority areas of needs traditionally met by the state, going beyond mere technology. Active portfolio manager, allocating financial and technical resources to working groups. Operating in accordance with the zero-based budgeting principle. Investing money in a targeted way rather than in 'production of fixed assets'. Provoking the creation of spin-offs. Cross-checking development potentials.
- **Animator of private funds for use-driven and applied research projects.** 'One-stop shop' for businesses, but without exclusivity rights – just one of the players.
- **Public procurement agent** – procuring innovative technologies or R&D work in selected areas. In this way, the broker may act through a parallel mechanism of 'sucking in' and 'driving' innovations.

**Given the nature of innovative process, the broker must be prepared to deal with a large number of small-scale projects**




Source: In-house analysis.

Figure 29. Role of large and small-scale projects in innovative practice

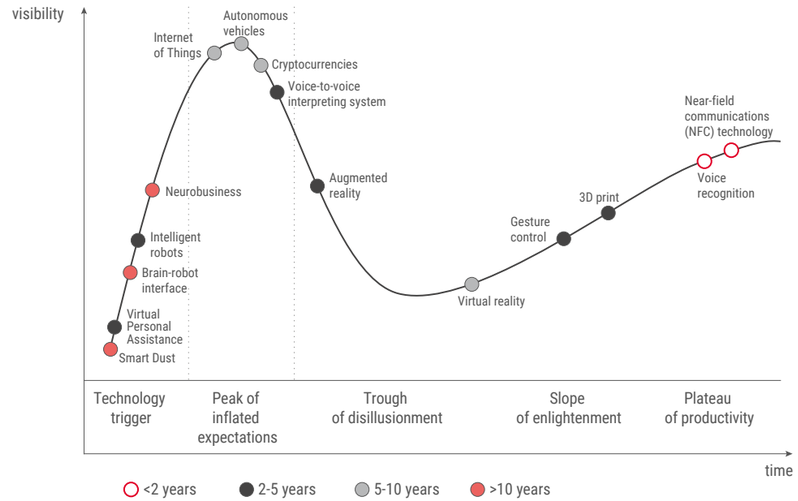
## In creating economic priorities, let's not bet on 'dark horses'

**Betting on a technology may stimulate the imagination, but when it comes to innovation it actually diminishes the chances of success**

Picking out the dark horses may be particularly deceptive, if you look at Hype Cycles prepared by Gartner – an IT consulting firm. In between editions, many technologies disappear from the graphs, as the media buzz surrounding them turns out to be mostly an effect of peak expectations.[42] Catching up with the innovators responsible for such technologies is also unlikely, given their head start in experience. On the other hand, the path of innovation from an innovator's perspective is forked and often winding, unlike in ex post analysis, when attention is on the successful technology. Cassette tapes may be a good case in point. Sometimes a technology changes its application – 20 years after the kerosene lamp had been invented, it seemed that Edison's light bulb would put an end to the oil industry, whose revenues were based on the sales of lamp oil. But kerosene found a new application, in internal combustion engines.

By investing in a technology at the peak of its popularity, we risk significant losses. Shifting the focus to solutions that better meet an existing need, we increase the chance of getting a valuable product.

**The most hyped technologies do not always mean the best business prospects – at least not today**
selected examples




Source: In-house analysis based on Gartner.

Figure 30. Hype cycle

[42] For more details, see: Gartner, *Hype Cycle 2015*, www.gartner.com

## Autonomous corporate development units: a key enabler in transferring prototypes to the added value chain

**Businesses will always be closer to the customer than even the best of brokers**. To make them more open to innovation, it would be worthwhile to facilitate the creation of in-house development units.

**Internal innovation development units represent an attempt to adapt Israeli experience to Polish conditions**. Israel has strongly supported start-ups, benefiting from sales of licensed technologies. In Polish conditions, we can follow suit, but the economy must develop toward a manufacturing model – the country is too large to turn completely into a knowledge-based economy within a short time span.

**The state can support innovation at companies by changing the labour law so that an employee's intellectual property rights are also protected**. An individual who can enjoy financial benefits of his or her idea is more likely to develop it.

### CONCLUSIONS

To harness the potential of businesses in transforming innovative projects into national components of the value chain, we recommend:

- **Opening in-house innovation development units** as a tool to receive prototypes at strong companies looking to expand globally from the Polish market;
- **Green-lighting innovation risk at state-owned companies**;
- **Changing the labour law** – the right to an idea created by an employee should stay with the employee, where as now it remains with the company. As a result, employees lack motivation for creative work, but also – once they reveal their good ideas – in order to remain innovators they must come up with another invention, which is much more difficult;
- **State refinancing of risks associated with the organisation of one or two crowdsourcing rounds and implementation of results** (to create a demonstration effect – 'do a pilot project, see for yourself');
- **Temporarily reducing, as an incentive, non-salary labour costs for newly created R&D positions** requiring doctoral degrees.

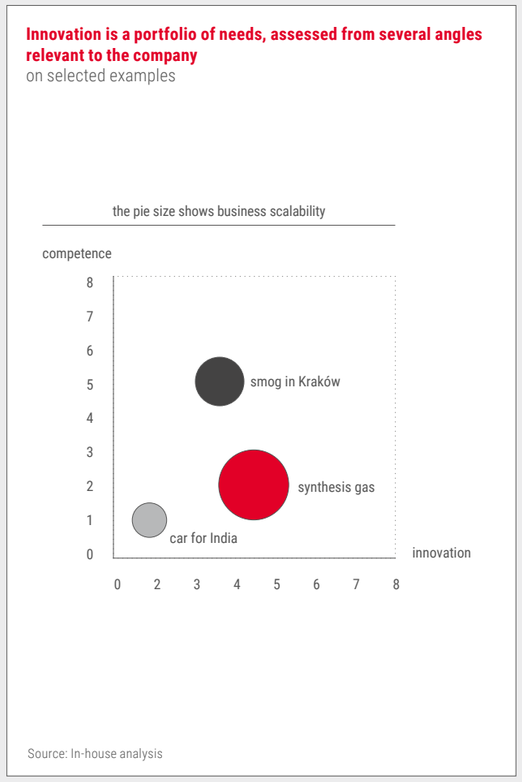




## Support for companies in organising dedicated development units would increase the chances of delivering innovations that would meet the economy's needs

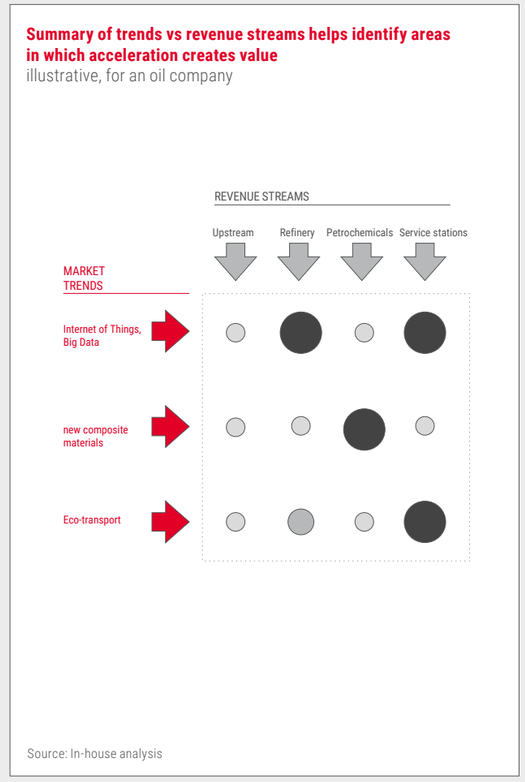
**Dedicated support units should catalyse the flow of innovation from confirmed prototype to business scaling.** If properly defined, they may help in responding to strategic trends. They should create innovation portfolios to achieve results despite the attendant risk, generating mutual benefits for the organisation and start-ups.

**The way in which development units function, they must be separated from the organisation.** While they are tightly corsetted by procedures and processes, they lead projects in line with the practice of agile management, based on a limited set of non-financial KPIs. Through close contact with employees, they provide start-ups with access to the corporation's specialised services, bringing about changes in the organisational culture. Teaching the practice of portfolio management, they may be used as the foundation for future development of corporate venture capital funds.




Source: In-house analysis

Figure 31. Competence vs innovation matrix for project portfolio




Source: In-house analysis

Figure 32. Innovation drivers

## Promotion of use-driven research will align science with the needs of business and the state

**We should abandon the traditional division into basic research, whose purpose is to create new knowledge, and applied research, involving the practical application of science. Let us add use-driven research into this classification**. This type of research combines the practical goals of applied research with the development of new knowledge, typical of basic research. Popularisation of use-driven research would allow scientists not to give up their cognitive aspirations for the sake of profit-driven development work. Firms would find this type of research easier to finance and commission as its results are more ready for application than the results of traditional basic research.

South Korea is one of the countries which were successful in gradually bringing together the paths of universities and business. The shift involved science and technology – from development work and applied research to basic research and from imitating technologies to creating in-house solutions. The cooperation between universities and companies was gradually intensified in the subsequent development stages of the country.

An example of use-driven research is, in our view, the development of the theory of producing natural gas from soft rock and clay – corresponding to the fracturing theory based on which the hydraulic fracturing technology and shale gas production were developed.

To reach the development level of Finland, where 63% of R&D spending is financed by business, the science system needs products that can be commercialised by the private sector. Use-driven research is the type of scientific inquiry which can be acquired by a firm without resorting to arguments of social corporate responsibility.

### CONCLUSIONS

**In order to harness the potential of universities to push the national economy towards innovation we recommend the following:**

- empowerment of scientists – allowing technologies developed based on publicly financed infrastructure to be owned by scientists as intellectual property which can be contributed to a start-up business; this enhances the attractiveness of use-driven research as scientists create their own capital of knowledge that can be transformed into financial capital without having to give up on their research goals and interests;
- discounts for large corporations to acquire research from scientific centres suitable for their core business, e.g. from National Scientific Lead Centres (KNOW), and also from universities; identification of scientific initiatives which will be undertaken by ARP on request by a company and financed with its funds, to replace basic research with applied research and commercialise the results;
- grants for research projects that conform to the national innovation mission and identified security needs;
- creating incentives for universities to reach further into the flow of ideas as part of Knowledge and Innovation Communities in Europe (European Institute of Innovation and Technology (EIT) + Wrocławskie Centrum Badań in Poland);
- taking advantage of the opportunity to transfer knowledge and exchange scientific staff via a contact network between partner towns (and reaching their scientific centres).

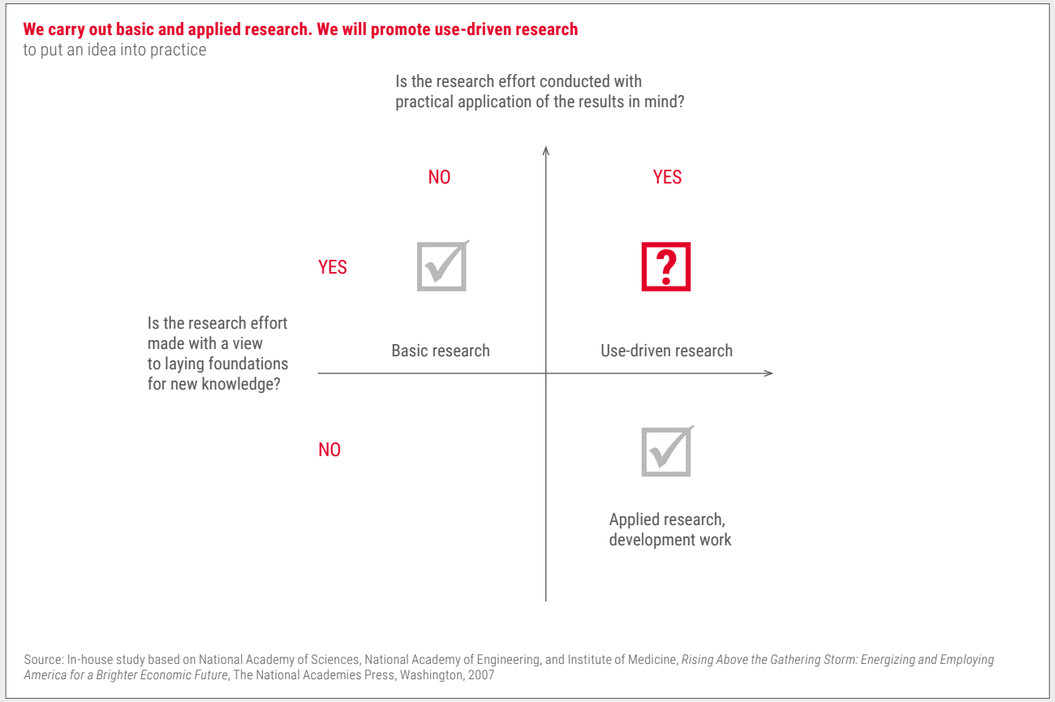




## Does the practical side of scientific research make it cognitively uninteresting?

Inasmuch as basic research should rely on scientists' intuition, aspiration and knowledge regarding the directions of research, in the context of innovation preselecting scientific disciplines is a mistake. Unlike scientific policy, innovation policy must be as technology neutral as possible, and must begin with the need which should dictate what type of research will be performed and what technologies developed. An innovation policy cannot therefore preselect the scientific disciplines as part of which new solutions will be created – what matters is for the solutions to meet actual needs.

**To combine science and business it is a good idea to promote use-driven research, i.e. research combining fundamental knowledge and specific goals**. An example of use-driven research are the cognitive efforts of Louis Pasteur.[43]




Source: In-house study based on National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, The National Academies Press, Washington, 2007

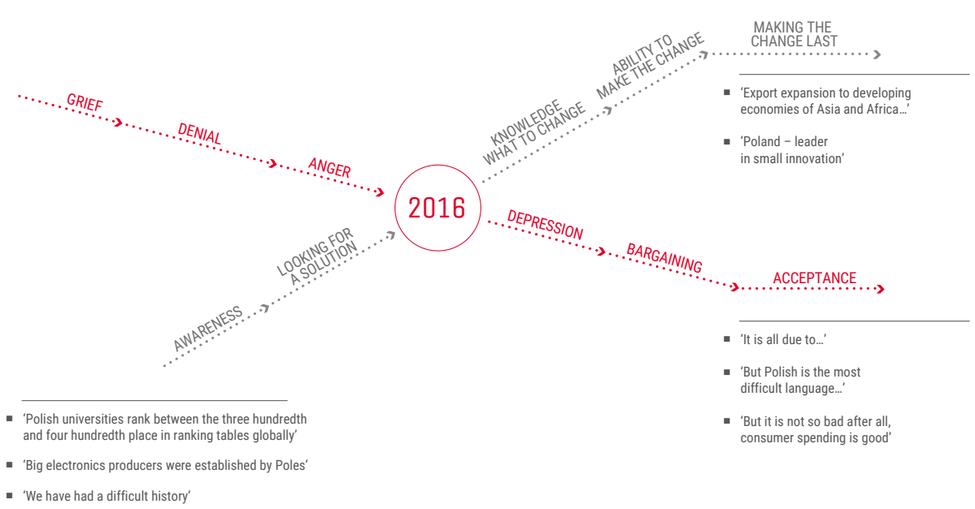
Figure 33. University research matrix

[43] cf. National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, The National Academies Press, Washington, 2007

## We fuel the future!

*You may ask how the story of Mr Inventive ends. 'What do I do?,' Mr Inventive wonders. 'Will I be able to create an innovative business by myself? Everyone around already knows what to do, their thinking is right, and still it is so hard to make them join forces.' After months of trials and thinking Mr Inventive begins to see the weak spots of his prototype greengrocery 'Ripe Here, Ripe Now!'. Fruit needs ethylene to ripen quickly and this requires an expensive installation that is hard to put in place in small shops. Moreover, a vegetable's shelf life is only a few hours, so it is a much better idea to centralise ripening facilities. 'If only I had been told this at the Trading Centre, the company I tried to work with, I would have made corrections to my model right away. The project would be different, but with a chance of market success. It's so sad! Innovators like me are plenty and their energy is sapped by big and small obstacles'. Mr Inventive will try for the second and then for the third time – after all the spirit of entrepreneurship is not so easy to kill. The question is: Will we join him on this new journey?*

**Now we are at the crossroads – what headlines do we want to read in a few years? We will either put the plan into action or the energy will dwindle**




Source: In-house analysis.

Figure 34. Two possible growth paths



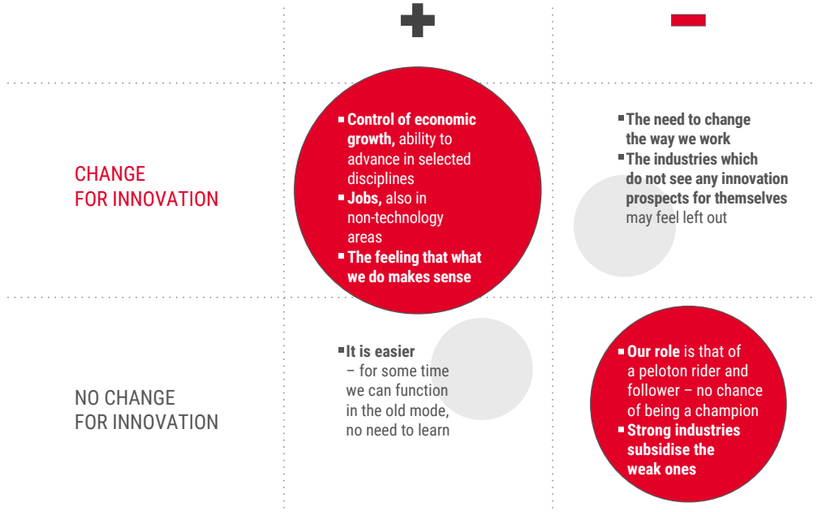


**How long will Polish economy thrive before a slowdown hits? How much longer is it before our industries achieve a competitive advantage?** Where are we in the global value chain? What is the cost of a kilogram of goods exported from Poland? Can we buy more time by taking advantage of fiscal and monetary policies? Does the economy as a whole have to be innovative or will creating champions be enough?' All these questions were asked during discussions on the Polish economy.

**Now it is time to plant trees. Unfortunately, what worked in the past will not pass the test in the future**. Seeing how distant the horizon is for innovative efforts to bear fruit we may, but do not have to, falter. After all, our cultural background predisposes us to accept delayed gratification. So we get ready for the future today. What will be the driving force of our growth after 2020, when we turn from a receiver of EU funds into a net payer? John Stuart Mill, British philosopher and economist, said that human nature is not a machine to be built after a model, and set to do exactly the work prescribed for it, but a tree, which requires to grow and develop itself on all sides, according to the tendency of the inward forces which make it a living thing. According to a Chinese saying, the best time to plant a tree was 20 years ago. The second best time is now.

Let us make the creative leaven for innovative economy right now. In this way we will be able to take advantage of a unique opportunity to shape our future.

**Innovation Let's win the game!**




Source: In-house analysis.

Figure 35. Consequences of change for innovation

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