APPLICANT'S HANDBOOK

The National Centre
for Research and Development

WOULD YOU LIKE TO LEARN MORE ABOUT SUBMITTING APPLICATIONS FOR FUNDING FROM NCBR?

- To find out more about NCBR, please visit www.ncbr.gov.pl
- Detailed information on current NCBR programs and competitions as well as instructions on how to fill in applications can be found on the NCBR's website in the Current Competitions tab: https://www.ncbr.gov.pl/aktualne-konkursy/
- Is your project ready to submit your application to NCBR? Check it with the **Innovation Assistant** available at: https://asystentinnowacji.ncbr.gov.pl/
- At the end, use the NCBR **Applications Generator** and see for yourself! lsi.ncbr.gov.pl
- If you need additional explanations about NCBR's grant and procedures for applying for funding, please contact the NCBR Information Point (by e-mail: info@ncbr.gov.pl, by phone +48 22 39 07 170 or in person at the NCBR headquarters at Nowogrodzka 47a Street in Warsaw).

The National Centre
for Research and Development

Warszawa, 2019

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APPLICANT'S HANDBOOK

INTRODUCTION

Dear Madams and Sirs,

I am pleased to present to you the „Applicant's Handbook„ - a short, practical publication, containing the most important information for innovators - potential Applicants for National Center for Research and Development (NCBR).

Working on a daily basis with representatives of science and business, we realize that despite many changes and facilities that we introduce in the competition documentation, preparing an application for co-financing of R&D project can constantly involve various doubts. Maybe this especially concern entities or companies applying first time for financial support for their innovative projects. „Applicant's Handbook" is a publication that will help you find answers to key questions about applying process.

The content of this document also allows you to systematize thinking about the project - from the phase of R&D work planning, by going through parts of application for co-financing, which allows step by step walk through the application process and do your best to prepare for it with examples. You will find descriptions of different areas, practical tips and questions about the application. We provide valuable information of inspiring implementations. „Applicant's Handbook" also systematizes knowledge about the benefits of R&D projects.

I hope the publication will be useful both for those of you who already manage R&D projects, and also for people who are planning it. I wish you inspirational reading and good luck with the implementation of innovative projects. I also hope that thanks to the "Applicant's Handbook" the National Center for Research and Development will have more often the opportunity to support the development of innovative initiatives that respond to current challenges.

Wojciech Kamieniecki, EngD
Director of the National Center
for Research and Development

THE PURPOSE

The aim of this guide is to support potential beneficiaries of the National Centre for Research and Development (NCBR), in particular entrepreneurs and scientific units, in the process of preparing a rationally justified application for co-financing a research and development project (R&D).

The guidelines contained therein will help you in identifying, preparing and submitting for evaluation of a R&D project that meets the requirements of NCBR. With this document, you will be better prepared to apply for financial support from NCBR - it will be much easier to develop a thoughtful project. It will also be easier to achieve your success by transforming the results of scientific research into impressive market innovations.

WHAT IS IN THE GUIDE?

- The essence of the R&D project
- Types of R&D projects co-financed by the NCBR
- Benefits from the implementation of research and development projects
- Examples of R&D projects
- Preparation of a R&D project:
  - Formulating research questions
  - Determining the target market
  - Development of an implementation plan and commercialization strategy
  - Preparing the project budget
  - Risk management
  - Determining indicators and milestone

PUBLIC SUPPORT FOR R&D PROJECT

The mission of the National Center for Research and Development is to support R&D projects and develop the ability to create innovative solutions in key sectors of Polish industry. Their development translates into a significant increase in the competitiveness of the Polish economy worldwide. In carrying out its mission, NCBR acts as a platform connecting students and employers, scientists and entrepreneurs as well as innovative solutions and capital resources for their implementation. It provides the conditions for inventions created in Poland to be solutions sought after on the world markets. It creates an ecosystem that attracts a growing number of investments at the highest technological level. NCBR programs focus on developing research in areas of priority importance for Poland and implementing their results in the economy.

R&D projects include activities aimed at extending knowledge about nature, economy and society and creating new applications of this knowledge. NCBR supports R&D projects including:

- **INDUSTRIAL RESEARCH:**
  Works aimed at acquiring new knowledge with perspective of practical use
- **EXPERIMENTAL DEVELOPMENT WORKS:**
  Works based on knowledge gained from research and practical experience, aimed at creating new and improving existing products and processes
- **READ MORE:**
  Commission Regulation (EU) No 651/2014 of 17 June 2014.

ABOUT NCBR

The National Center for Research and Development (NCBR) is an executive agency of the Ministry of Science and Higher Education. It was established in the summer of 2007 as a unit implementing tasks in the field of science, science, technology and state innovation policy. At the time of its establishment, the National Center for Research and Development was the first unit of this type in Poland, created as a platform for effective dialogue between the science and business environment.

In the EU financial perspective 2014-2020, the NCBR acts as an Intermediate Institution for operational programs: Smart Growth and Knowledge Education Development.

The activities of NCBR are financed from the State Treasury and the European Union funds. Projects co-financed from the EU funds must fall within the framework of the National Intelligent Specialization – the areas indicated by the Polish government to increase the innovation of our economy.

BENEFITS OF THE R&D PROJECTS

The return on investment in R&D projects can be very high, even for small and medium-sized enterprises. Due to the funding from NCBR enterprises can increase their competitiveness on the market and improve their financial results. R&D projects enable enterprises to achieve positive effects such as:

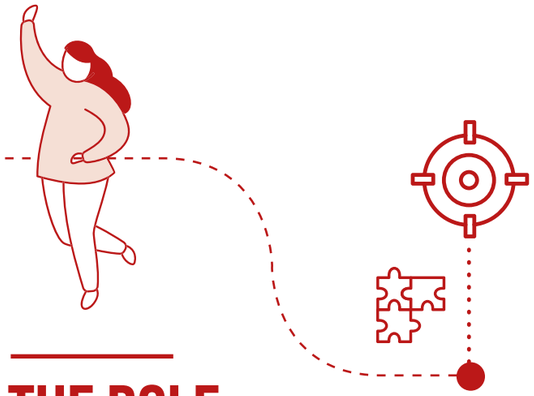
- **PROVIDING INNOVATIVE GOODS OR SERVICES FASTER OR IN A MORE EFFICIENT WAY**
  R&D projects can increase the company's productivity by developing new techniques or production processes that reduce operating costs.

- **REDUCING THE ENERGY CONSUMPTION AND RESOURCES NEEDED FOR PRODUCTION**
  Specialist knowledge derived from R&D works can help the company reduce the demand for energy and materials in production processes. Thanks to this, the company will increase profits, generating benefits for society and the natural environment.

- **DEVELOPMENT OF A NEW OR SIGNIFICANTLY IMPROVED PRODUCT, BASED ON THE USE OF NEW MATERIALS OR PRODUCTION METHODS**
  The results of investments in R&D projects can help in the creation of new products and services and stimulate the improvement of existing products.

- **INCREASED COMPETITIVE ADVANTAGE**
  The company can gain a competitive advantage by distinguishing the offer with new and improved products on the market.

- **ENTERING NEW MARKETS AND CREATING THEM**
  R&D projects give the chance to enter new markets or products that - due to their innovativeness - will create completely new markets.



THE ROLE OF NCBR'S CO-FUNDING

The risk inherent in the implementation of R&D projects means that many enterprises and organizations have difficulties with financing from their own resources. NCBR reduces business risk by providing financial support for industrial research and experimental development work. Nevertheless, the share of the beneficiary's own resources in the investment is significant. It gives experts assessing applications and NCBR the assurance that the beneficiary believes in his idea and confirms his commitment to the project. Therefore, the NCBR wants to share the costs of the R&D project with the beneficiary. In other words, NCBR returns the company the costs of project implementation in the percentage specified in the project budget. The exact part of the costs to be reimbursed is governed by the rules for the call for project applications in a given competition. This level depends on the size of the enterprise and the level of the prototype's readiness over which the beneficiary works during implementation.

In certain programs financed by the National Center for Research and Development, the amount of public aid obtained can be increased by disseminating the project results on a large scale through the conference, publication or distribution of open source software.

The share of public aid varies depending on the risk of the project. The closer the market solutions are works carried out in the project, the lower is the level of available funding (see below).

NCBR'S CO-FINANCING SUPPORTS VARIOUS ENTITIES, INCLUDING:

- universities,
- large enterprises,
- micro, small and medium companies,
- research institutes (often as subcontractors)..

Co-financing levels vary depending on the type of entity.

COOPERATION WITH NCBR CAN BRING SIGNIFICANT BENEFITS:

- funding for NCBR helps to cover the costs of conducting industrial research and experimental development works, thanks to which it is possible to support the development of new or significantly improved techniques and innovative solutions,

- in contrast to loans granted by banks, NCBR does not require repayment of funds allocated to cover the costs of activities carried out under the project.

HORIZONTAL PROGRAMS

NCBR supports R&D projects which results can be used in various industries simultaneously.

Previously implemented programs included:

- advanced energy generation technologies

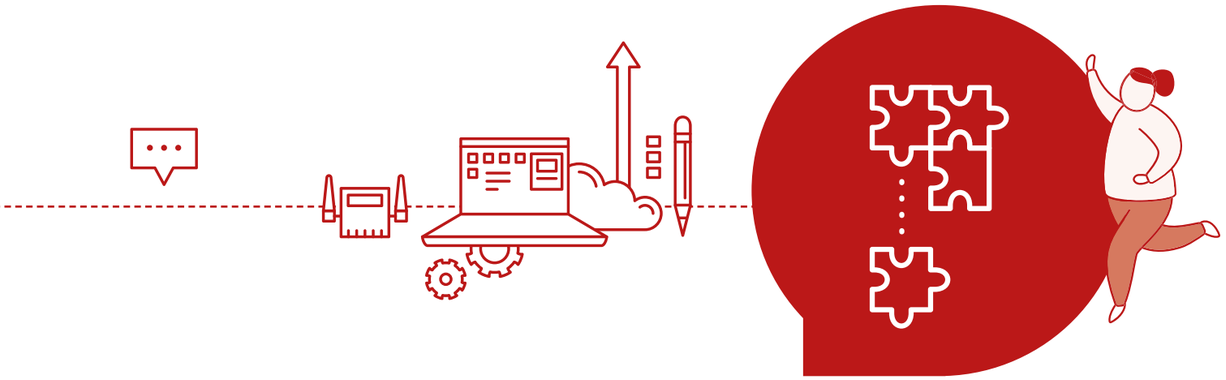
- interdisciplinary system of interactive scientific and technical-scientific information

- integrated system for reducing energy consumption in buildings

- optimization of work safety in mines

- technologies for the development of safe nuclear energy

- projects from other areas (National Intelligent Specializations)



APPLICATION STAGES

The process of applying for NCBR funding is carried out according to the stages included in the diagram. Depending on the program, the process steps may differ in details.

GENERATING IDEAS/IDEAS

- Applicants are looking for ideas, asking questions that have remained unanswered so far, and examining the possibilities of meeting previously unsatisfied market needs.
- The ideas mature until the stage of formulating the R&D project by developing specific technical assumptions, market applications and implementation strategies.

PREPARATION AND SUBMISSION OF THE APPLICATION/CONCLUSION

- Applicants look for programs tailored to the needs of their research project in the NCBR's offer.
- Applicants refine the descriptions of their projects, collect relevant materials and fill out the required forms.

FORMAL AND SUBSTANTIVE ASSESSMENT/EVALUATION

- The NCBR assesses the application in terms of eligibility and compliance with relevant regulations and recruitment rules, including the formal and substantive evaluation of the application.
- NCBR sets up a panel of independent experts to assess the merits of the application.
- Applicants have the opportunity to improve the submitted application (the scope of improvement is limited, the improvement takes place before the panel).

NEGOTIATION OF THE CONTRACT/AGREEMENT

- If the project receives a positive evaluation, the Beneficiary prepares documents for signing the contract for co-financing.
- At this stage, negotiations/cuts of budget expenditures may also take place if the NCBR considers them ineligible for co-financing.

PROJECT IMPLEMENTATION AND MONITORING OF PROGRESS/REALIZATION

- Beneficiaries start implementing the R&D project in accordance with the agreed schedule and budget.
- Beneficiaries implement milestones and report to the NCBR on the progress of work in the project; if necessary, changes in the project schedule are made.
- The NCBR performs payments in accordance with the approved project costs.

WHAT ARE THE RESEARCH AND DEVELOPMENT WORKS?

The impulse to start research and development work is to find a solution to specific problems. Can you solve it? Or maybe change something that already exists for the better? Can the new solution work? In our opinion, it is best to understand the essence of R&D, analyzing examples from various industries.

EXAMPLES:

- JIf I introduce changes in the process of iron contamination removal, will I create high quality steel with limited energy consumption?
- If I design a new coronary stent, will this reduce the likelihood of recurrent artery stenosis that can lead to undesirable cardiac disorders such as myocardial infarction?

Answers to these questions are unknown. It is not known whether the application of the new method of removing contaminants from iron will be associated with a lower energy consumption. There is no certainty that the new stent will reduce the likelihood of recurrent artery stenosis.
It is the uncertainty that makes R&D investments different from capital investments where the answers are known. For example, it is known that installation of a new, faster machine on the packaging line will increase the number of handled packages.

TYPES OF INNOVATIONS:

- **PRODUCT INNOVATION**
  is the introduction of new goods or services or the application of significant improvements in the characteristics or use of existing goods and services.
- **PROCESS INNOVATION**
  means applying a new or significantly improved method of production or delivery in practice.

WILL YOUR IDEA FIND A MARKET?

The answer to this question will be positive if the results of R&D works are practical and feasible. This is what makes the market innovation. In other words, ideas are used to improve products and services or improve processes. For example, if a new stent reduces the risk of arterial stenosis (restenosis), it should be sold as a medical device.

Benefits resulting from the project, assuming that it will be successful, should be clearly presented in the part of the application devoted to the description of the project. It should be clearly indicated what is improving and indicate what will be the improvement for society, i.e. how it will affect the satisfaction of **market demand.**

- What is **the problem**, that requires a solution?
- How does your solution eliminate or significantly reduce this **problem**?
- What makes this solution **better** than the one currently used?
- If the solution turns out to be a success, **how will the market look like**?

- What is the estimated **size of the market**?

  You can estimate it by analyzing the size of the market for competitive solutions, or by assessing how your market would increase thanks to the proposed improvement compared to its current size.
  You should be precise.

EXAMPLES OF R&D PROJECTS

The following are examples of R&D projects. **It should be remembered that the applications submitted to the NCBR will have to include detailed explanations regarding the research question, methodology and strategy for implementing the results of R&D works.**

MATERIALS: HIGH-PERFORMANCE METALLURGY

- **IDEA:**
  If I introduce changes in the process of removing impurities, I will create high quality steel using much less energy.
- **RESEARCH PROGRAM:**
  Checking various steel production methods and evaluation of the process results and the amount of energy needed.

- **AREA OF APPLICATION AND MARKET DEFINITION:**

  The new process enables steel producers to produce high quality steel used in air and land transport, infrastructure and construction of skyscrapers, using less energy, and therefore at a lower cost.

HEALTH: A NEW TYPE OF STENT

- **IDEA:**
  If I develop a stent with new geometry, it will reduce the risk of restenosis.
- **RESEARCH PROGRAM:**
  Checking the effectiveness of a new type of stent in reducing the risk of restenosis compared to existing types of stents.

- **AREA OF APPLICATION AND MARKET DEFINITION:**

  A new type of stent may be offered to patients with an increased risk of restenosis.

WOOD INDUSTRY: EFFICIENT WOOD PROCESSING

- **IDEA:**
  If I create a new wood cutting system, I will be able to get more raw material from felled trees.
- **RESEARCH PROGRAM:**
  Evaluation of the quantity and quality of the raw material obtained using the new wood cutting system in comparison with the performance of existing technologies.

- **AREA OF APPLICATION AND MARKET DEFINITION:**

  The use of a more efficient wood processing technique in the woodworking industry enables obtaining more functional goods while limiting the negative impact on the environment.

TARGET MARKET

You should accurately describe your target market by specifying its size. Who is a customer? How many clients are there?

Your target market will be a part of the entire market available for your solution. **Formulate clear** assumptions about estimated market size. In addition, the application refers to potential changes in estimated volumes over time. **Quote** the credible sources underlying your assumptions, such as scientific articles or published market research.

AN EXAMPLE OF HOW TO DETERMINE THE TARGET MARKET: A NEW TYPE OF STENT

In 2014, 126 241 coronary angioplasty procedures were performed in Poland. Drug-eluting stents were used in 83.5% of cases. This corresponds to the target market for the solution. Patients receive stents currently available on the market („available target market"). Despite the presence of solutions in this field on the market, studies have shown that angiographic restenosis occurs in over 10% of patients. If the new stent proves to be a better solution than the current methods of preventing the occurrence of restenosis, then the target market will be part of the available target market, threatened by the increased restenosis risk. According to the results of the „Multi-center nationwide health survey", 6.8% of the Polish population has diabetes. Diabetes is one of the risk factors associated with long-term adverse clinical effects after stent implantation. The number of people suffering from diabetes in Poland increases. It is estimated that by 2030, between 2.2 and 2.5 million Poles will suffer from this disease. It follows that the size of the market will increase with the passage of time.

The above data comes from reliable sources:*

COMPETITION MARKET

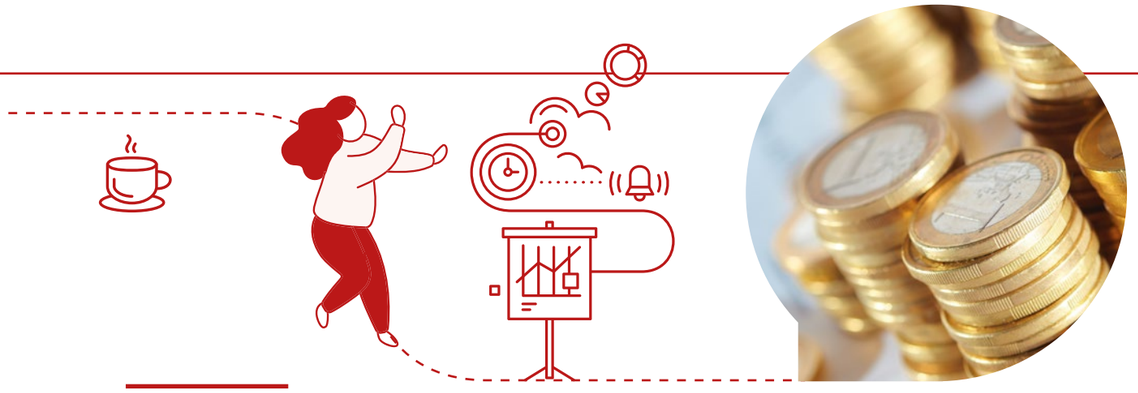
- You must present the main competitors on your target market. Refer to both existing solutions and those that you think are expected on the market. Compare these products with the potential of your solution.
- Your solution may have features that can not be directly compared to existing solutions. However, information should be provided on other solutions with partially similar or related functionalities.

EXAMPLE: Competition in the treatment of coronary angioplasty
- Uncoated metal stents
- Drug-eluting stents
- Balloon angioplasty
- Cutting balloon
- Removal of atherosclerotic plaque
- Vascular brachytherapy

QUOTE: Alfonso Fernando, Byrne Robert A., Rivero Fernando, Kastrati Adrian, "Current Treatment of In-Stent Restenosis", Journal of the American College of Cardiology (2014) no. 63 (24).

* from the scientific article - Byrne, Robert A., Michael Joner and Adnan Kastrati. „Stent Thrombosis and Restenosis: What Have We Learned and Where Are We Going? The Andreas Grüntzig Lecture ESC 2014. „European Heart Journal 36.47 (2015): 3320-3331,

* from the report - Ochała, Andrzej et al. „Percutaneous interventions in cardiology in Poland in 2014. Report of the Board of Association of Cardiovascular Interventions of the Polish Cardiac Society (AISN PTK). „Advances in Interventional Cardiology 11.3 (2015): 177-181.



IMPLEMENTATION PLANS

If you successfully complete your R&D project then the contract for co-financing will oblige you to implement its results.

The NCBR wants to support projects which results can be introduced into the economy.

After determining the target market for your solution, you need to describe how the product will be marketed, i.e. how you intend to implement it. Begin by describing how to implement. The following options are available:

- your company will start **production** or start **providing services** based on the results of the project,
- you will **license** another entity so that it can manufacture products or provide services,
- you **sell the rights** to use the project results to another entity, so that it can build products or provide services based on them.

In the case of a new type of stent, the inventor may decide to grant in implementing solutions, that is, the one that will eventually produce stents.

Regardless of the chosen method of project implementation, you need to estimate what will be offered on the market (e.g. a new type of stent). You need to specify how the product will be distributed (for example, the stent manufacturer will deliver them to hospitals) and marketed (for example, through the education of doctors through scientific publications and presentations). The method of determining the price of the product should also be clearly specified and compared with the prices of the competition. You have to clearly specify where the numbers you provide come from, they can only be estimations. You must show that you know the cost of your solution and know if it will be competitive with other entities - in absolute terms, or thanks to the savings resulting from the lack of adverse effects. Such knowledge should in a logical way translate into the ability to estimate revenue streams.

FORECAST EXPENSES

There are two types of costs - **fixed costs and variable costs**. Fixed costs do not change in a short time and are independent of the production volume. The variable costs depend on the production volume. These include, but are not limited to, the production, marketing and distribution of your product. You can estimate the expected costs by comparing them with the production costs of similar products.

In the example for a new type of stent, compare them with the costs of another stent. You need to estimate everything - from the cost of raw materials (such as polymers), to packaging and stent implantation (can stent be implemented using standard tools and methods?), as well as labour, marketing and customer service costs (will you need a helpline to support with implantation stents or selecting appropriate patients?).

IMPLEMENTATION: REVENUE ESTIMATION

FORECAST EXPENSES

Indicate how sales are recorded in your industry. If you describe the service, you can enter billable hours. In the case of a product such as a stent, it will be the number of stents.

Based on the target market analysis, calculate the total sales by multiplying the number of units that each customer would have purchased by the market share you estimated. Your market share will increase gradually, which should be reflected in the numbers presented. Then multiply the number received by the frequency with which customers will make the purchase. Consumables can be bought more often than capital investments. Estimate the total sales volume by multiplying the number obtained by the average selling price. Then compare the size obtained with the results of known competitors, thus showing the cost advantage of your solution against the competition.

annual sales expected =
number of clients
x average number of purchases
per 1 customer throughout the year
x average selling price

EXAMPLES OF COSTS: A NEW TYPE OF STENT

A new type of stent will reduce the occurrence of restenosis, which will translate into a reduction in treatment costs. These savings result from the lack of need to treat serious cardiac disorders. The company patented the results of its project and uses its own factory for the production and distribution of new stents. Competition stents are characterized by other costs and restenosis rates.

A comprehensive approach also takes into account market risks. These are external conditions that may negatively affect your ability to get the estimated sales. These threats can be divided into the following categories:

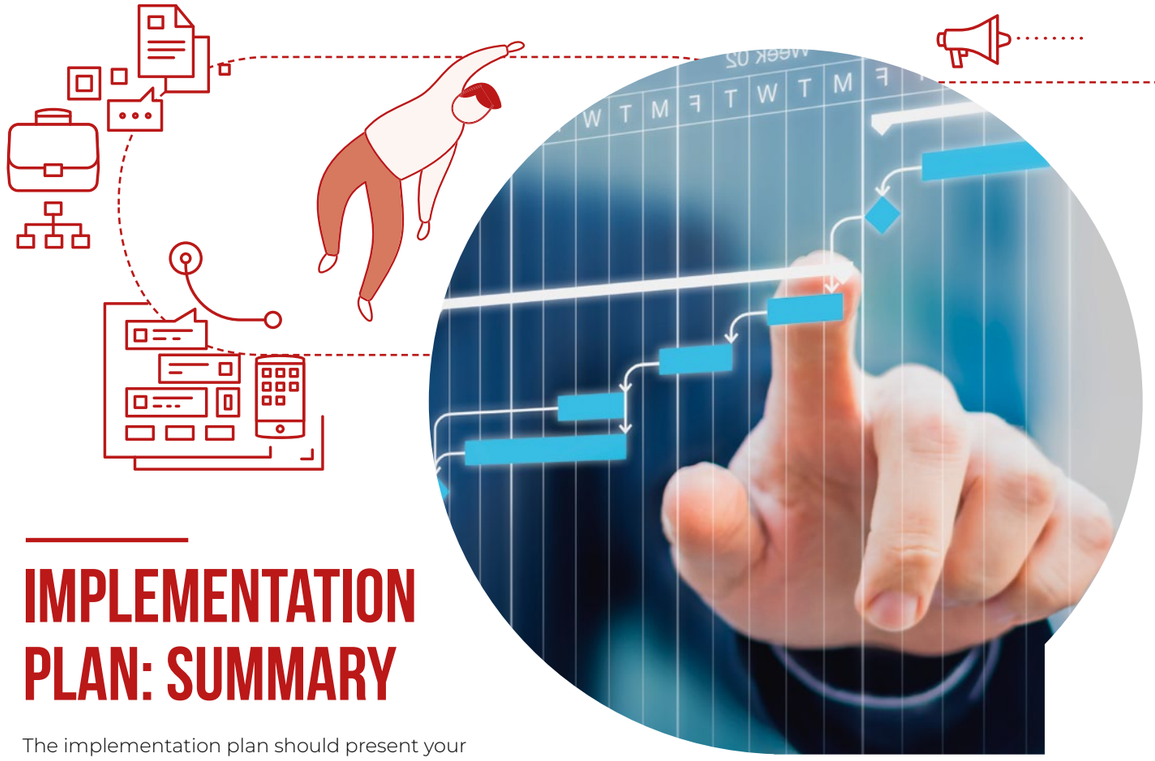
- competition threats: introduction of the same or better solution,
- threats from the legal or administrative environment: permits, regulations, etc.
- the threat resulting from the change in the number of customers on the target market.

You must present possible ways to reduce these risks:

- Can your solution be applied to something else?
- Will the new application find a new market?
- Can changes be an opportunity to develop a new product?
- If so, what should be changed in your action plan?

EXAMPLES OF MARKET RISKS: A NEW TYPE OF STENT

In the case of stents, it may be a risk for the competitor to introduce a stent that prevents restenosis from occurring in 100% of patients. One way to address this threat is to see if the stent can be used to prevent obstruction in other parts of the body. There may also be legal obstacles, which may result in the need to change the target group of the product - from humans to livestock.



IMPLEMENTATION PLAN: SUMMARY

The implementation plan should present your vision of the company and the manner in which the proposed innovation responds to market needs. To do this, prepare a convincing justification of the value of your product or service to the target customer.

CUSTOMER NEEDS:
What are the needs we want to satisfy?
What problems do we want to solve?

COMPANY'S COMPETENCES:
What skills do we actually have to meet these needs?

COMPETITION:
Who is our competitor in meeting these needs?
How big is our competition?

COLLABORATORS:
Who should we involve to cooperate with?
How do we want to motivate our colleagues?

CONTEXT:
What cultural, technological and legal factors limit our capabilities?

Remember that customers are sensitive to the price; scale effects are important; adequate production capacity must be ensured; reference should be made to the risks from the competition.

Not all the benefits of implementing the results of R&D projects can be expressed in quantitative sales data. Some of them refer to qualitative data, i.e. a higher quality of life for customers.

REMEMBER: **RISK** IS AN INHERENT FEATURE OF **R&D** PROJECTS AND **NCBR** SHARES THIS RISK WITH YOU

The research and development project requires a specific commercialization strategy for the results obtained. Nevertheless, R&D projects are always burdened with a certain degree of uncertainty, so as the work progresses, you have to take into account the need to adapt the action plan to the needs of the project.

IMPLEMENTATION PLAN: EXAMPLES

	MATERIALS	HEALTH	WOOD INDUSTRY
CLIENTS NEEDS: What kind of needs can we satisfy?	• The aspiration of producers to manufacture steel while reducing energy costs	• Patients with a very high risk of atherosclerosis often experience restenosis after placing the stent, which is associated with the threat of serious cardiac disorders	• More effective obtaining wood from trees • Reducing negative impact on forests
COMPANY'S COMPETENCES: What special competences do we have to satisfy these needs?	• Materials • Chemistry • Metallurgy	• Biomedical engineering • Cardiology • Materials	• Machinery • Engineering • Forestry
COMPETITORS: Who is our competitor in meeting these needs?	• Existing steel production processes	• Biotechnology companies that produce stents available on the market	• Existing producers of woodworking tools and equipment
EMPLOYEES: Who should we involve to cooperate with? How do we want to motivate our colleagues?	• Partnership with well-known steel producer • Sharing savings from reduced energy costs	• Cooperation with experts in the field of animal stents models • Sharing prestige and information about the possibilities that R&D funds provide	• Cooperation in the development of the project with sawmill operators • Offering discount on machines
CONTEXT: What cultural, technological and legal factors limit our possibilities?	• Reliance on existing processes and the need to learn new methods • Availability of specialized machines and devices	• Healthcare law • Practices regarding medical settlements • Lack of knowledge about the types of stents among healthcare providers	• Demand for wood • Relations with the construction industry and furniture • Environmental law

TECHNOLOGICAL READINESS LEVELS: MONITORING THE PROCESS OF TECHNOLOGY DEVELOPMENT

The NCBR's goal is to co-finance research and development works that have a positive impact on the economy and society. Progress in the implementation of projects in the field of industrial research and experimental development works is measured by the ability to transfer ideas from the laboratory to the market, using for this purpose the assessment of the level of technology readiness TRL (Technology Readiness Level).

When planning a R&D project, it is worth placing the technology on the TRL scale and determining the start and end of the project (e.g. I am starting a project at TRL level 4 and ending with TRL 9).

Projekt badawczo-rozwojowy wymaga sprecyzowanej strategii komercjalizacji uzyskanych wyników. Niemniej jednak, projekty B+R są zawsze obciążone pewnym stopniem niepewności, dlatego w miarę postępu prac musisz liczyć się z koniecznością dostosowywania planu działania do potrzeb projektu.

At the first levels of the TRL scale, we gain new, practical knowledge. Going through successive levels of technological readiness, we use the knowledge we have acquired to prepare technology to bring it to the market.

In principle, the NCBR finances projects in the field of TRL2-TRL9, where TRL2-TRL6 levels are industrial research, and TRL7-TRL9 – experimental development works.

TRL SCALE

TRL 1 – Basic principles observed

TRL 2 – Technology concept formulated

TRL 3 – Experimental proof of concept

TRL 4 – Technology validated in lab

TRL 5 – Technology validated in the relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 6 – Technology in a relevant environment (industrially relevant environment in the case of key enabling technologies)

TRL 7 – System prototype demonstration in operational environment

TRL 8 – System complete and qualified

TRL 9 – Actual system proven in operational environment

EXAMPLES:

BEGINNING: Available scientific studies indicate that some contamination with elements can be removed from molten iron at different temperatures, and this process can lead to the beneficial characteristics of the products offered.
GOAL: Before the end of the project, the team produced a small piece of steel in a process requiring less energy under controlled laboratory conditions.

BEGINNING: A new, small-scale cutting machine, efficiently harvesting timber from trees in a simulated sawmill environment was presented.
GOAL: The finished version of the cutting system is installed and works efficiently in various real conditions.

NOVELTY – A FUNDAMENTAL FEATURE OF GOOD R&D PROJECTS

ERGO: HAS ANYONE DONE IT BEFORE?

In your application for funding must be a comprehensive analysis of the current state of knowledge in the field covered by the project. The descriptive part of your application should convince expert evaluators that your research question has not yet been answered. The results of your work are aimed at providing answers for the benefit of society. Describe in detail what others are doing in this area, what works (yours and others) have been carried out on a given research question in the past. Do not forget to estimate the risk of your R&D project, i.e. assess your chances of success.

If you come to the conclusion that no one has answered the question so far, and previous work suggests that it is possible, you must determine whether the answer can be obtained as part of a systematic methodology. This means that you must carry out your research work in a timely manner that will answer the question. What is more, you can repeat the research to make sure you get the same answer every time. The reproducibility of the results can only be demonstrated by applying systematic tests.

Carefully formulate your **research hypothesis**. To an overly broad question, it is not possible to answer within narrowly focused research work. If the subject of your research interest is too narrow or too difficult to discover, it may also not be measurable as part of your systematic research.

INTELLECTUAL PROPERTY RIGHTS

Do not wait until the end of your research project to think about intellectual property. Already in the early stages of project planning, think about how existing IP laws that belong to other organizations and people can affect your research? Think about how you will have your IP rights and what strategy you will adopt to protect your competitive advantage. The awareness of IP protection issues will help ensure the return on investment of your time and resources, as well as improve the Polish ecosystem of innovations.

CURRENT STATUS

Existing IP rights can be an obstacle to the commercialization of your research results. It is necessary to analyze the current status of IP rights in order to confirm that your idea is really innovative. Many inventors assume that their idea is innovative, while in fact it has already been researched by others. It's a mistake! Professional patent offices and resources, such as the European Patent Office or the World Intellectual Property Organization, can help you analyze the current status of IP rights.

GRANTING OF INTELLECTUAL PROPERTY RIGHTS

Specify how you share the IP rights generated in your research and development project between project team members. Which persons or organizations will be granted rights to the results generated in the project? How will the revenues from licenses be divided? Make sure that these issues are thoroughly discussed and agreed, especially if your team is a consortium of organizations implementing the R&D project.

STRATEGY FOR THE PROTECTION OF IP RIGHTS

Think about how you can protect the results of your R&D project. The most appropriate IP protection strategy may vary depending on the nature of your project. Obtaining patents is just one of the forms of IP protection strategy, and the protection of inventions used by many companies relies more on trade secrets and the registration of trademarks. As the results of research and development works are unpredictable, even the best IP protection strategy for your project may be ineffective.

REMEMBER ABOUT INTELLECTUAL PROPERTY (IP) AT EVERY STAGE OF YOUR PROJECT.

DESCRIPTION OF INDUSTRIAL RESEARCH AND DEVELOPMENT: KEY QUESTIONS

WHAT ARE YOUR GOALS?

- Clearly indicate what new knowledge your project will generate
- Examples:
  - Undetected phenomena
  - New structures
  - Unexplored relations
- These factors contribute to the uncertainty of the R&D project

WHAT IS INNOVATIVE IN YOUR PROJECT?

- Clearly point out the creative approach to the research problem
- Examples:
  - A new application of existing scientific knowledge
  - New applications of available techniques or technologies

WHAT RESEARCH METHODS AND TECHNIQUES WILL YOU USE?

- Methods of scientific and technological research
- The methods should take into account the uncertainty of the results of the R&D project

HOW CAN THE PROJECT RESULTS BE APPLIED IN OTHER AREAS?

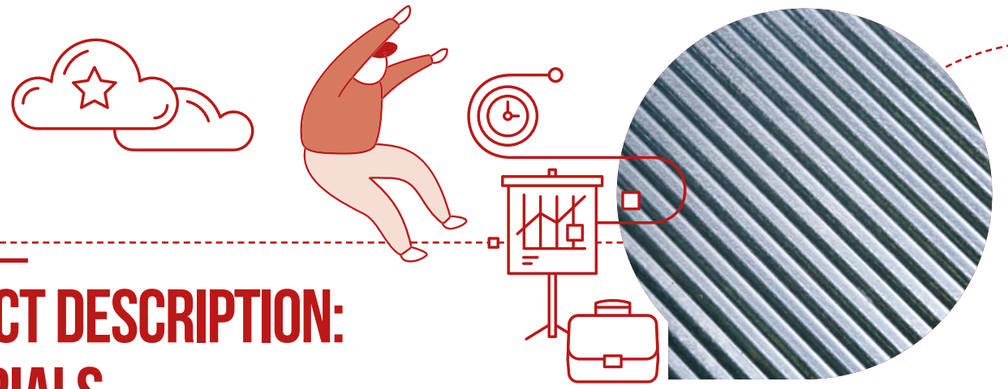
- The results should be reproducible
- The results should be protected by intellectual property rights and then published in scientific journals

WHO WILL CARRY OUT THE WORK UNDER THE PROJECT (NUMBER OF PEOPLE, THEIR TASKS AND COMPETENCES)?

- Researchers/scientists (do not forget about the manager of R&D works in the project)
- Technologists
- Other support staff (including the manager managing the R&D project)

HOW WILL YOU MANAGE YOUR INTELLECTUAL PROPERTY RIGHTS?

- If intellectual property is created, what will be the method of its protection (e.g. copyrights, trademarks, patents, rights to industrial designs, trade secrets)
- How will you gain access to the intellectual property rights you intend to use in your project? (e.g. purchase, IP license)
- How will you use or share the intellectual property rights created in the project so that they will benefit the Polish economy and society? (e.g. own implementation, sales, IP license)



PROJECT DESCRIPTION: MATERIALS (EXAMPLE)

WHAT ARE YOUR GOALS?
- The discovery of new methods of removing pollutants in the steel production process.
- Development of new steel production processes that consume less energy.

WHAT KIND OF NOVELTY WILL BE PART OF YOUR PROJECT?
- Different techniques will be used in the research, which are usually not used in the production of steel.

WHAT RESEARCH METHODS AND TECHNIQUES WILL YOU USE?
- As part of the project, various methods of heat treatment will be systematically tested (heating, annealing, cooling) in the context of energy consumption and the efficiency of removing pollutants.

HOW CAN THE PROJECT'S RESULTS BE USED IN OTHER AREAS?
- The new process can be scaled in pilot production in larger plants.
- The process reduces the costs of energy needed to produce steel, and steel alone can be used in various sectors of the economy.

WHO WILL CARRY OUT THE WORK UNDER THE PROJECT?
- Materials scientists
- Metallurgists
- Project manager and administrative/financial support staff

HOW WILL YOU MANAGE YOUR INTELLECTUAL PROPERTY RIGHTS?
- The project leaders will negotiate licenses with steel producers, trying to implement a new process in their factories.

PROJECT DESCRIPTION: HEALTHCARE (EXAMPLE)

WHAT ARE YOUR GOALS?
- The creation of a paper machine with very high efficiency, allowing to increase the amount of cellulose raw material obtained from trees.
- Increasing the efficiency of the domestic wood industry while limiting the negative impact on the natural environment.

WHAT KIND OF NOVELTY WILL BE PART OF YOUR PROJECT?
- The new device cuts tree trunks in a new sequence and in a different layout than the industrial techniques prevailing in the market.

WHAT RESEARCH METHODS AND TECHNIQUES WILL YOU USE?
- Evaluation of the quantity and quality of cellulose raw material obtained with the use of the new system in comparison with the efficiency of existing technologies.

HOW CAN THE PROJECT'S RESULTS BE USED IN OTHER AREAS?
- Once the design team has obtained a patent for a new technique, the machine performance results will be published in the industry magazine.

WHO WILL CARRY OUT THE WORK UNDER THE PROJECT?
- Mechanical engineers
- Woodworking technologists
- Researchers in the field of forestry and environmental protection

HOW WILL YOU MANAGE YOUR INTELLECTUAL PROPERTY RIGHTS?
- The team can protect its intellectual property by patenting it and then negotiate licensing to other companies intending to use the new technology.

PROJECT DESCRIPTION: WOOD INDUSTRY (EXAMPLE)

WHAT ARE YOUR GOALS?

- Creation of a paper machine with high performance, allowing increase of the amount of cellulose raw material obtained from felled trees.
- Increasing the efficiency of the domestic wood industry with simultaneous limitation of negative impact on the environment.

HOW CAN THE PROJECT'S RESULTS BE USED IN OTHER AREAS?

- After the project team obtained a patent on a new technology, machine performance results will be published in the industry journal.

WHAT KIND OF NOVELTY WILL BE PART OF YOUR PROJECT?

- The new device cuts the tree trunks in the new sequence and in a system other than techniques prevailing on the market.

WHO WILL CARRY OUT THE WORK UNDER THE PROJECT?

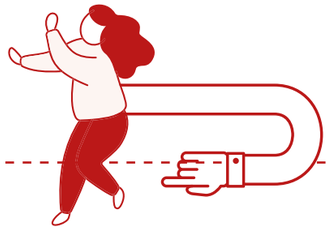
- Mechanical engineers
- Woodworking technologists
- Forestry and environmental protection scientists

WHAT RESEARCH METHODS AND TECHNIQUES WILL YOU USE?

- Assessment of quantity and quality of cellulose raw material acquired using the new system compared to performance of existing technologies.

HOW WILL YOU MANAGE YOUR INTELLECTUAL PROPERTY RIGHTS?

- The team can protect their intellectual property by patenting it, and then negotiate the licensing other entities the use of new technology.



MILESTONES

The part of the application devoted to planning describes the individual stages of the project implementation. These steps must clearly explain what actions will be taken to answer your research question. The R&D project implementation plan should be clearly divided into stages by setting milestones to finish each one.

Milestones allow measuring the progress of works and should provide a clear reference point to assess whether the project should be continued, improved or ended.

Milestones must be concrete, measurable, achievable, result-oriented and time-limited. They should be measured in specific values, for example, numeric or percentage.

The R&D project is associated with uncertainty. It may happen that some milestones will not be achieved. Risks related to research and development can be reduced by considering potential threats in the action plan.

Potential risks and how to approach them should be discussed in the part of the risk management proposal. Some risks, such as the loss of human capital, can occur at any stage of the project. They can be reduced by taking specific actions. These events do not necessarily have to stop the entire project. The plans for limiting particular types of risks must be presented in detail in the project.

Other risks are an integral part of the idea itself - your idea may be inherently doomed to failure. It is important that these risks are identified at an early stage of the project, with the help of specific milestones. They can also be reduced by applying a different approach or stopping the project.

WELL-DEFINED MILESTONES ARE:

SPECIFIC – set the stage that closes the milestone unambiguously, leave no room for loose interpretation

MEASURABLE – specify or at least suggest an indicator of the progress of project implementation

ASSIGNED – determine who will be responsible for achieving a given milestone

REALISTIC – determine what results are realistically possible to achieve, taking into account the available resources

TIME-SPECIFIC – specify deadline when individual results can be achieved

MILESTONES (EXAMPLES)

MATERIALS: HIGH-PERFORMANCE METALLURGY

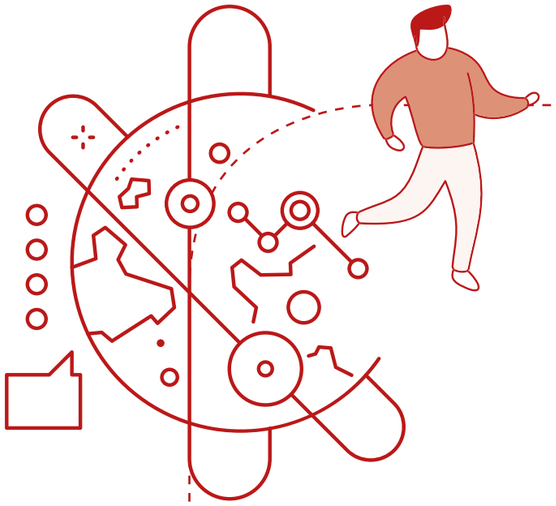
- Reducing the amount of waste heat by 20%
- Lowering the content of pollutants by 10% in comparison to existing metallurgical methods
- Reducing energy use by 30%

WOOD INDUSTRY: EFFICIENT WOOD PROCESSING

- Obtaining 20% more timber from cut trees compared to existing methods
- Hourly woodworking efficiency is 30% higher
- 40-minute periods between failures

HEALTHCARE: A NEW TYPE OF STENT

- Conducting preclinical safety studies on animal models
- Ensuring the safety of stent use for people
- Ensuring the effectiveness of stent application
- Confirmation of improvement compared to other stents



EXAMPLES OF RISKS AND WAYS TO REDUCE THEM

In the part concerning the risk management proposal, the risks for research and development should be specified and the steps that will be taken in the event of a given threat or event occur. Here are some hypothetical examples:

MATERIALS: HIGH-PERFORMANCE METALLURGY

- The new process may reduce the amount of energy needed to make steel, but it may also require more time to remove impurities. In this case, the team may consider the use of the process in specialized applications, not in plants that focus on maximizing production volume.

HEALTHCARE: A NEW TYPE OF STENT

- The stent may not reduce the risk of restenosis (as compared to existing products), causing serious cardiac disorders. In this case, the team may take into account other geometric patterns.
- A stent can pass tests on animals, but not on humans. In this case, the team may consider using a stent in farm animals..

WOOD INDUSTRY: EFFICIENT WOOD PROCESSING

- The process may not achieve the expected performance for all types of wood, so the team will focus on increasing the yield for a particular type of tree.

RESOURCES FOR THE R&D PROJECT

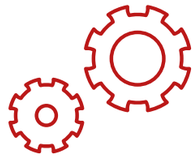
Research and development requires resources, including human, financial, technical and intellectual resources. Your application must clearly indicate how you will meet the requirements for project resources.

HUMAN RESOURCES

Experts assessing your application must be convinced that you have a team with the knowledge and skills necessary to complete the project. Your application should contain detailed information on the skills and previous experience of team members. The descriptions should directly refer to the nature of the work proposed as part of the project and the work carried out by you and your team in the past..

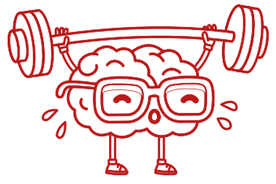
FINANCIAL RESOURCES

R&D projects require financial expenses for materials, human resources and infrastructure. NCBR will help you finance your expenses, reducing your financial risk. However, these expenditures must be properly planned. If you need equipment to conduct research and you do not have it, you can take into account the cost of depreciation related to the purchase of the necessary equipment or the costs of using equipment (leasing, renting). Remember that public aid covers only the fixed budget of the project.



TECHNICAL RESOURCES

Describe the equipment needed to carry out the work as part of the R&D project. You can already have some (or all) devices. Your application should specify in detail the necessary equipment and how to access this equipment. Are you the owner of the equipment or do you lease it? What expenditures on equipment maintenance are necessary and will these costs be included in the financial resources?



INTELLECTUAL RESOURCES

Intellectual resources include intangible assets, such as licenses, patents, trade secrets and business or production process models. If they are necessary to achieve the goals of your R&D project, you must explain whether you have them or how you will obtain them for the project.

RESOURCES: PLANNING AND PARTNERSHIP

CREATING A FINANCIAL SCHEDULE

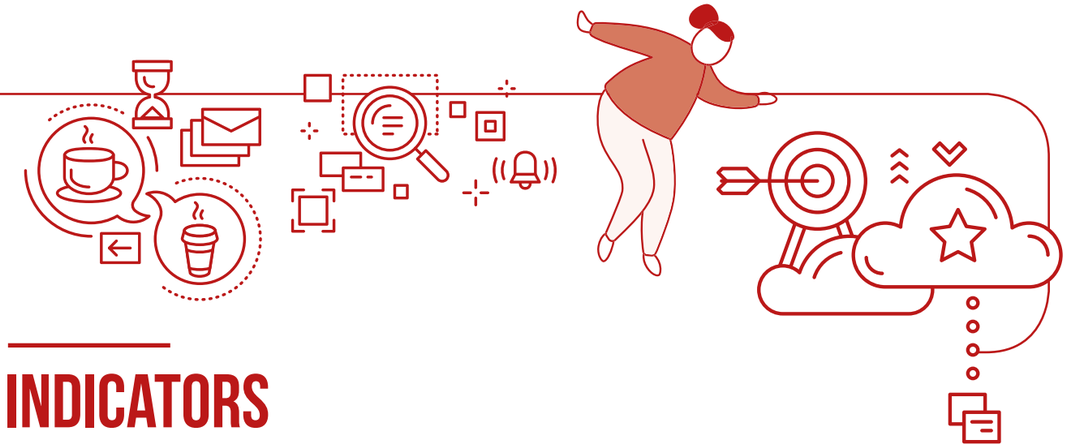
Your application should address all resource requirements and must clearly specify what resources will be needed to complete each task. The budget should correspond to the individual stages of the action plan.

In the example of a new type of stent, the task of developing a stent geometry and creating its prototype requires at least one biomedical engineer and the appropriate equipment. The budget should take into account the remuneration and certificates for the engineer performing the work and materials such as metal or polymers. To test the stent on an animal model, budgets should include animals, people carrying out analysis, materials, etc.

Resource planning in a R&D project is just as important as the project idea itself. The use of resources should be planned so that they are enough to complete each of the tasks in the project. You also have to plan cash flows for the whole project, because the public aid only covers costs that do not exceed the previously determined values..

PARTNERS FOR R&D WORKS

A good team to carry out research and development is the key to the project's success. However, not all the people participating in the project must be employed in your organization. NCBR often finances a group (consortium) of organizations cooperating with a given project. You can use human resources from outside your organization, thus increasing your options. Partners can also provide technical and financial resources. However, you must manage your employees and subcontractors to ensure convergence of their activities with their goals.



INDICATORS

The NCBR programs involve the implementation of specific goals, such as reducing energy consumption or improving the economic situation in Poland. To monitor the degree of achieving different goals, use appropriate indicators. Goals can be achieved both during and after completing the project. The indicators measured during the project should be directly related to the achievement of the objectives of the entire project, which are measured after its completion.

The application should present the beginning value of the indicator (for example, the amount of materials that are currently necessary to produce a given product, the number of deaths caused by the disease) and how much the indicator would change if the project was successful. You should also explain how the indicator will be measured (e.g. national statistics on deaths, etc.).

Examples of indicators that can be measured **after the project is completed:**

- number of created start-ups,
- use of renewable energy sources,
- reducing the number of deaths caused by the disease.

MATERIALS
- Reduction of energy used in the steel sector
- Reducing greenhouse gas emissions
- Development of the steel sector
- New infrastructure and construction projects

HEALTHCARE
- Limiting the occurrence of restenosis in the stent
- Reduction in the number of serious cardiac disorders after stent implantation
- Improving the quality of life

WOOD INDUSTRY
- Increasing the efficiency of the Polish wood industry
- Limiting the impact of tree felling on forests
- General development of wood processing technologies in various sectors

REMEMBER THAT THE INDICATORS SHOULD BE SPECIFIC I.E. THEY SHOULD EXPRESS A CHANGE IN VALUE OR PERCENTAGE IN RELATION TO THE BASE VALUE OF THE INDICATOR (E.G. MEASURED AT THE START OF THE PROJECT).

IN CASE OF FAILURE

If the R&D project was carried out in accordance with the plan included in the contract, but it was unsuccessful this is not a reason for shame. Thanks to this you have learned why something does not work and you can use this knowledge in the next project. The NCBR will refund the incurred part of the project costs.

CREATING A R&D PROJECT: A SUMMARY

The time from the idea to obtaining the benefits of introducing the results of the R&D project to the market may differ significantly. Much depends on the type of project, e.g. software projects are much shorter than biomedical projects that require testing on humans. Ideally, if the question or hypothesis to be tested in the project can bring benefits not only to your company or laboratory. The results should provide benefits to the general public in Poland.

Work on a research and development project should follow specific steps. The first step is to define an idea in the category of actions to be taken to answer the research question and determine the final benefits for society. Before you start thinking about how to do something, consider whether there is a market for the results of the project, if it turns out to be a success. If you can not apply the results on a wider scale or they do not bring significant benefits, there is no need to waste time thinking about how to do something.

After analyzing the market and determining that there is a market for your idea, the next step is that you should carry out an in-depth analysis of the state of knowledge in the area of the subject of the project. It may happen that someone has already tried to answer your question, which may discourage you from continuing the project or make you approach the problem in a different way. Perhaps someone has already done something similar - in this case, you can include in your project already obtained results and refer to what you have done and what has not been successful. It is important to have and present knowledge about the phenomena underlying your research question.

For example, in stent research, you need to know what makes a stent effective and why some designs have not been successful. Due to this, NCBR is convinced that this type of research can be effective and that your idea is innovative.

After completing the market analysis and reviewing the results of previous research, you are ready to plan your R&D project. The plan should contain specific stages that lead to achieving milestones that allow both you and the National Center for Research and Development to follow the progress of the project. The description of these stages should be detailed and contain enough information that will allow the experts to assess the completeness of the project and convince them that you will implement the project in accordance with the plan presented. The description of each stage will help you organize activities that you should take during project implementation and specify their time frame (whether the activities will take one day or a whole month?). This will also help you plan the project budget because time and actions translate into procurement costs and labour costs. Milestones are an opportunity to reassess the approach and introduce any changes.

The culmination of work on the creation of an R&D project should be to set indicators that, according to your expectations, will change - as a result of effective project implementation (starting from the project start date to the project end date and - during the project lifetime from its completion). These indicators may include, for example, the use of knowledge generated by industry - as part of licensing patented solutions or may relate to the amount of water saved through new processes.

Indicators must be measurable and adequate.
Work on a research and development project

After completing the steps describing the work on the preparation of the R&D project you can join the NCBR. Public aid changes the financial risk of your project.

NCBR offers many programs and competitions, find the ones that concern your research question.

You also need to specify your own funds that you can allocate to the project, because the NCBR does not cover 100% of your total project implementation costs.

After submitting the application, you must attend a meeting with NCBR experts who evaluate your application (panel) and then, if you receive funding, you can start the project. One should remember about many issues related to the Polish public procurement law, catalogue of eligible costs, reporting requirements (reports) and introducing possible adjustments in the project according to the progress of works. The NCBR offers information and advice in this area that will help you obtain funding for your R&D project.

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National Centre for Research and Development
Nowogrodzka 47a Street
00-695 Warsaw
tel: +48 22 39 07 401 fax: +48 22 20 13 408
REGON: 141032404 NIP: 701-007-37-77

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