Tento projekt je financován se státní podporou Technologické agentury ČR v rámci programu BETA2
www.tacr.cz
Výzkum užitečný pro společnost

Úřad vlády České republiky

Challenges & Megatrends Methodology

Output 1 of the FUTURE-PRO project:
Megatrends and grand societal challenges

VELKÉ SPOLEČENSKÉ VÝZVY
MEGATRENDY

End-user of the results: **Office of the Government of the Czech Republic**
nábřeží Edvarda Beneše 4
Praha 1 - Malá Strana
Postcode 118 01

Abbreviated project title: FUTURE-PRO: Megatrends and grand societal challenges

Full project title: A proposal for a methodology to identify megatrends and grand societal challenges with a significance for the Czech Republic and for research in the Czech Republic and their first identification

Project number: TITDUVCR946MT01

Project promoter: České priority (Czech Priorities, NGO)

Project duration: October 2020 – June 2021

Confidentiality and availability: publicly available

Information on the implementing team:

ČESKÉ PRIORITY

Head of the author team:
Ing. et Ing. Kateřina Jiřinová

Authors of the CM Methodology:
PhDr. Ladislav Frühauf; Mgr. et Mgr. Marek Havrda M.A., M.P.A., Ph.D.; Ing. et Ing. Kateřina Jiřinová; Mgr. Jan Kleňha; Alexandre Reznikow, M.A.

Other collaborators of Czech Priorities, contributing with their observations:
Mgr. Marek Bičan, M.A.; Bc. Hana Kalivodová; Bc. Adam Kouba; Markéta Ovečková; Bc. Filip Šourek; Bc. Andrea Vuová

The Czech Priorities team wishes to thank for precious advice and help in designing the Methodology to the expert team and external experts:
PhDr. Pavel Baran, CSc.; doc. PhDr. Jozef Baruník Ph.D.; Mgr. Karel Čada, Ph.D.; RNDr. Jana Dlouhá, Ph.D.; doc. Mgr. Bc. Libor Dušek, Ph.D.; Mgr. Tomáš Gavenčiak, Ph.D.; Mgr. Miroslav Havránek; RNDr. Šárka Hudecová, Ph.D.; doc. Petr Janský, Ph.D.; PhDr. Mgr. František Kalvas, Ph.D.; Mgr. Denisa Kera, Ph.D.; Mgr. Tereza Kochová; doc.; RNDr. Ing. Miloš Kopa, Ph.D.; Marcel Kraus, MSc.; Mgr. et Ing. Jiří Lehejček, Ph.D.; Mgr. Jaromír Mazák, Ph.D.; doc. Václav Němec, Ph.D.; Lucie Nencková, Ph.D., MBA.; prof. Ing. Danuše Nerudová, Ph.D.; David Ondráčka M.A.; Ing. Michal Pazour, Ph.D.; doc. Ing. Vladimíra Petráková, Ph.D.; Mgr. Barbora Petrová, Ph.D.; Martina Plisová, Ph.D.; doc. PhDr. Michal Pullmann, Ph.D.; Mgr. Eva Richter, Ph.D.; Ing. Jiří Schneider, Ph.D.; Ing. Martin Srholec, Ph.D.; doc. RNDr. Jana Straková, Ph.D.; Mgr. et Mgr. Hana Tenglerová; doc. PhDr. Jan Váně, Ph.D.; Mgr. Martin Víta; Bc. Daniel Všetečka, MSc.

Special thanks to representatives of the contracting authority and in particular *Ing. Rut Bízková (RDI Council, TA CR); PhDr. Eva Brožová (MIT); RNDr. Martin Bunček, Ph.D.* (TA CR); *Ing. Daniel Kný, Ph.D. (OG CR) and Ing. Jan Marek, CSc. (RDI Council).*

The BETA2 programme of public contracts in applied research and innovation to meet the needs of government authorities was approved by Czech Government Resolution No 278 of 30 March 2016 and supports applied research and innovation required by state administration bodies. The funding provider is the Technology Agency of the Czech Republic (TA CR).

More information on the project:

This document was created under project TITDUVCR946MT01 "A proposal for a methodology to identify megatrends and grand societal challenges with a significance for the Czech Republic and for research in the Czech Republic and their first identification", the first of a series of projects covered by framework agreement TITDUVCR946 FUTURE-PRO, the aim of which is to create mechanisms to identify priorities in societal challenges and needs of research in the challenges. The title used for the project was "FUTURE-PRO: Megatrends and Grand societal challenges".

The project was initiated by the Government Council for Research, Development, and Innovation (RDI Council). The project promoter was the Czech Priorities think-tank whose mission is to systematically find the best solutions to societal problems.

The project was implemented from October 2020 to June 2021. It aimed to create and pilot a methodology for identification of megatrends and grand societal challenges significant for the Czech Republic (Czechia, Czechia). The project builds on the foresight approach, consisting in structured thinking about future developments. The time horizon of the foresight was 15-30 years, based on the available sources. The jointly defined basic requirements were: evidence-based approach, transparency, inclusiveness, repeatability, implementability and use of values frameworks for the quality of life, resilience and sustainable development.

List of documents created in the project:

- "**Challenges & Megatrends Methodology**" - the text of the CM Methodology, project output V1 (this document).
- "**Megatrends and grand societal challenges with a significance for the Czech Republic**" - pilot implementation of the CM Methodology, project output V2.
- "**Background research for the CM Methodology**" - a separate annex of output V1.
- "**Reflection on the pilot implementation of the CM Methodology**" - a separate annex of output V1.
- "**Cards of the areas of megatrends and grand societal challenges**" - a separate annex of output V2.

All the above documents are publicly available on the websites of:

- the project promoter Czech Priorities: https://ceskepriority.cz/megatrendy and
- TA CR: www.tacr.cz/projekt-future-pro-megatrendy-a-velke-spolecenske-vyzvy

The BETA2 programme of public contracts in applied research and innovation to meet the needs of government authorities was approved by Czech Government Resolution No 278 of 30 March 2016 and supports applied research and innovation required by state administration bodies. The funding provider is the Technology Agency of the Czech Republic (TA CR).

Glossary and abbreviations:

- ***CM Methodology*** *(Challenges and Megatrends Meth.): Methodology for identifying megatrends and grand societal challenges with a significance for the Czech Republic*
- ***MTs****: megatrends*
- ***GSCs****: grand societal challenges (of global nature, unless otherwise stated)*
- ***MT/GSC****: both MT and GSC in the context of an activity implemented concurrently for MTs and GSCs*
- ***Foresight****: a structured approach to presuming future developments*
- ***MT/GSC area****: thematic cluster of identified MTs/GSCs*
- ***Card of a MT/GSC area****: a structured document drawn up for a specific MT/GSC area*
- ***MT/GSC studies:*** *foresight studies and other studies generally focused on global megatrends and grand societal challenges*
- ***Sectoral studies****: studies focused on specific issues of MTs and GSCs*
- ***Quality of life****: Czech translation/equivalent of the well-being concept*

The BETA2 programme of public contracts in applied research and innovation to meet the needs of government authorities was approved by Czech Government Resolution No 278 of 30 March 2016 and supports applied research and innovation required by state administration bodies. The funding provider is the Technology Agency of the Czech Republic (TA CR).

Executive Summary

The aim of the project FUTURE-PRO: Megatrends and Grand societal challenges was to design and pilot a methodology for identifying megatrends (MTs) and grand societal challenges (GSCs) significant for Czechia, which would help formulating research priorities in social sciences, humanities and arts (SSHA). The methodology has been created and labelled "Challenges & Megatrends Methodology", shortly: CM Methodology (Output 1). The Methodology uses a *foresight* approach that is based on structured thinking about future developments.

To achieve the project objective, background research was conducted as the main source for designing the Methodology. The background research analysed 38 world studies dealing with MTs and GSCs, and conducted interviews with 41 foreign experts - authors or co-authors of the studies. The background research results were used to create a working version of the CM Methodology that was piloted in the second part of the project.

The CM Methodology makes it possible, in the first step, to identify global MTs and GSCs and group them thematically into MT/GSC areas, and, in the subsequent step, to prioritise the MT/GSC areas from the viewpoint of Czechia, and create a list of challenges relevant for Czechia in each of the areas.

The CM Methodology has four phases: 1 - Preparation, 2 - Identification of MTs/GSCs through desk-research, 3 - Verifying and supplementing the MT/GSC areas through a world café workshop and individual consultations, and 4 - Prioritising the MT/GSC areas by means of deliberation of experts in a Delphi exercice) and inputs from civic participation gained through a forecasting tournament. The criteria for prioritising the MT/GSC areas are the values frameworks of quality of life (well-being), resilience and sustainable development.

The CM Methodology was successfully piloted in the first half of 2021. The main outputs of the pilot implementation include 18 identified MT/GSC areas and structured documents describing the MT/GSC areas (see a separate annex "Cards of the areas of megatrends and grand societal challenges", only in Czech), a list of priority MT/GSC areas for Czechia and a list of challenges for Czechia, identified in each area. The procedure and results of the pilot implementation are described in a separate document (Output 2).

The final version of the CM Methodology was adjusted based on a reflection on the pilot implementation.

Contents

Introduction

The CM Methodology is intended to identify megatrends (MTs) and grand societal challenges (GSCs) significant for Czechia. It is part of the series of FUTURE-PRO projects that aims to design and apply mechanisms for identifying priorities in the area of societal challenges and needs of research in these challenges.

The main objective of FUTURE-PRO is to formulate ambitious research missions linked to the societal challenges to design solutions which would have the potential to significantly influence the quality of life in Czechia in the future. The implementation of these research missions would involve, apart from SSHA, also interdisciplinary research and would be mainly supported from public funds intended for SSHA and from other funding for innovation support. To determine the research missions, it is necessary to name future societal challenges that can be identified today.

The CM Methodology as an output of the first project out of the FUTURE-PRO series opens this topic. It makes it possible, in the first step, to identify global MTs and GSCs and group them thematically into MT/GSC areas, and, in the subsequent step, to prioritise the MT/GSC areas from the viewpoint of Czechia, and produce a list of challenges relevant for Czechia in each of the areas. The key prioritisation criterion is the quality of life in Czechia.

The fundamental approach of the CM Methodology is foresight. The essence of foresight is a structured approach to presuming future developments based on historical development and signals in the present, and to using the obtained knowledge for actions that help to co-create the future actively. It is a discipline that has been used for roughly seventy years in its modern form. Foresight was originally focused on the development of technologies but in the last 30 years it has expanded to cover more general societal topics such as sustainable development and quality of life[1].

In recent years, foresight has been on the rise in the EU - mainly thanks to the European Strategy and Policy Analysis System (ESPAS) that associates all EU institutions as well as in Joint Research Centres of the EU Commission. MT/GSC studies describing future challenges for EU public policies are regularly published there. From that it has been deduced that foresight is an adequate approach to identifying and prioritising MTs/GSCs. Foresight also uses participative methods where actors can jointly seek solutions contributing to the collectively defined objectives. The search for challenges significant for Czechia and the future definition of ambitious research missions for Czechia is certainly a goal that requires such broad involvement of actors.

[1] The development, methods and use of foresight are detailed in the document "Background research for the CM Methodology" (only in Czech) that is part of the project outputs. Foresight is also briefly introduced in chapter "The essence and benefits of structured thinking about the future" below.

Basic requirements placed on the Methodology

Before starting the preparation of the CM Methodology, the contracting authority together with the project promoter formulated the requirements for its quality. The purpose of that step was to maximise the legitimacy of the emerging methodology and to increase the likelihood that the methodology and its results will be accepted by concerned actors.

Evidence-based approach
The approach should be selected based on the world's best practice. As there are no rigorous evaluation studies, the approach is evidenced-based in that it builds on an extensive number of research projects carried out to date.

Transparency
The methodology should be transparent. The recommended methods should meet the required transparency of the process and outputs, and the final methodology should be published to enable its use by any entity.

Inclusiveness
In its development and implementation, the methodology should be discussed with a broad range of experts and partners who can propose modifications and supplements.

Repeatability
The methodology should be designed and described in detail regarding its repeated use in the future that is planned in the horizon of 3 years, and then every 5 years. In the next iterations, the methodology can be implemented by other entities.

Feasibility
The methodology should be designed so that it is implementable and should make maximum use of existing world and local outputs.

Sustainability In prioritising the MTs/GSCs, the methodology should build on the principles of sustainable development and quality of life improvements.

Conceptualisation and definition of the terms "megatrends" and "grand societal challenges"

The development of the methodology was preceded by background research (see a separate annex "Background research for the CM Methodology", only in Czech). The background research included analysing 38 world studies on MTs/GSCs[2], and conducting interviews with 41 foreign experts - authors or co-authors of the studies[3].

The background research also covered the issue of defining MT and GSC. The term "megatrends" is established in the literature and well conceptualised. "Grand societal challenges" are not usually explicitly defined in the literature, but the term "challenges" is frequently used. The definitions of MT and GSC based on background research for the CM Methodology:

- Megatrends: “Megatrends are relatively slow and certain directions of development, identified at the global level, and expected to change the face of the world substantially in the next decades.”[4]
- Grand societal challenges: "A cluster of problems requiring collective action for their solution in the future."[5]

The definitions of MT and GSC show substantial differences between the concepts. MTs can be seen as directions of development, the identification of which is not directly conditioned by the normative framework of their desirability. MTs are important for the analysis of related societal transformation processes and in general for analysing their impacts. GSCs are usually framed and addressed from the perspective of desirable goals. GSCs are often formulated negatively, as a risk threatening the development of the society. But they can also be formulated positively, as opportunities. Therefore, the framing and solution of GSCs is subject to a certain normative framework.

Thus, MTs and GSCs represent two different perspectives on how to think about the future in a structured way. The relationship between MTs and GSCs is ambiguous. GSCs could be viewed as impacts of MTs, but in some cases MTs and GSCs can complement each other, have no direct relationship, overlap or influence each other in another way. It is, therefore, relevant to explore MTs and GSCs together. Concentrating on MTs makes it possible to focus on impacts related to long-term trends. The use of the GSC perspective can help us to better focus on the related risks and opportunities. The use of two different perspectives contributes to a deeper analysis of trends and globally or regionally perceived challenges.

[2] List of studies in Annex 3
[3] List of interviewees in Annex 4
[4] See e.g. OECD (2016). *An OECD Horizon Scan of Megatrends and Technology Trends in the Context of Future Research Policy*
[5] See e.g. VERA (2012). Deliverable 1.2 Typology of RTDI directed towards Grand Societal Challenges, *VERA: Forward Visions on the European Research Area.*

The essence and benefits of structured thinking about the future

To understand the essence of structured thinking about the future by means of foresight, it is useful to mention a broader framework of reflections on the future[6]. An aspect that is associated with the future and that cannot be omitted is the limited predictability. That relates to the configurations of future situations, unknown in principle, with the freedom of human action that continues to bring something new into the world, with the factor of human inventiveness, creativity and ingenuity, with exponential developments of the world, disruptions and black swan events. From that perspective, the relationship to the future can be understood as a part of preparations for the new and unpredictable. In preparing for the future, it appears important to create suitable conditions fostering the above inventiveness, creativity and ingenuity, mainly by building structures that are flexible and operational.

Nevertheless, some signals about the future state of the world can be perceived already today, with greater or smaller uncertainty. That exactly is the domain of foresight. Foresight as such is based on the thesis that the future is structured by challenges that appeal to us in a given situation and to which we are to respond. The key point in our relationship to the future is whether we are able to understand such challenges and respond to them with our action, that is to formulate and implement solutions addressing them. Therefore, in the strategic considerations and preparation for future developments, we need to foster openness and sensitivity to these challenges.

Exploring and analysing the future is important in particular for governments and public institutions[7]. The substance of foresight is assuming the responsibility for co-creating the future as opposed to standing idly by and watching the future being formed by other forces. The structured reflections on the future also enable us to better understand the reasons behind the changes that are or will be required and that may be radical and even paralysing in a democratic society without sufficient preparation. Foresight is an incentive and a preparation for actively shaping the future. Apart from the outputs of foresight, a key aspect is the actual process that presupposes, supports and enables discussion among various groups in the society about what future we consider desirable and what challenges of the future we perceive already today. For foresight it is undoubtedly true that the journey is the destination.

Foresight also makes it possible to form specific measures of public policies and investments so that their effectiveness is maximised in the long term. Long-term planning taking into account challenges of the future that are reaching out to us today is highly worthwhile and at the price of short-term costs since it brings long-term benefits. Preparation for future developments of the society is an integral part of good governance in public policies because strategies and measures adopted in the light of future developments are significantly more effective, robust and resilient in the long term.

[6] Royal Society of Arts (2020). *A stitch in time: realising the value of futures and foresight*
[7] OECD-OPSI (2020). *Anticipatory Innovation Governance*

The Challenges & Megatrends (CM) Methodology

The CM Methodology is intended to identify megatrends and grand societal challenges significant for Czechia. In line with good practice, the Methodology has three main phases: identification of megatrends (MTs) and grand societal challenges (GSCs), their verification and supplementation with the help of experts, and subsequent prioritisation of MT/GSC areas from Czechia's point of view. These three main phases are preceded by a preparation phase at the start of the project. The CM Methodology has thus four phases: 1 - Preparation, 2 - Identification of MTs/GSCs, 3 - Verifying and supplementing the MT/GSC areas, 4 - Prioritising MT/GSC areas (see Diagram 1).

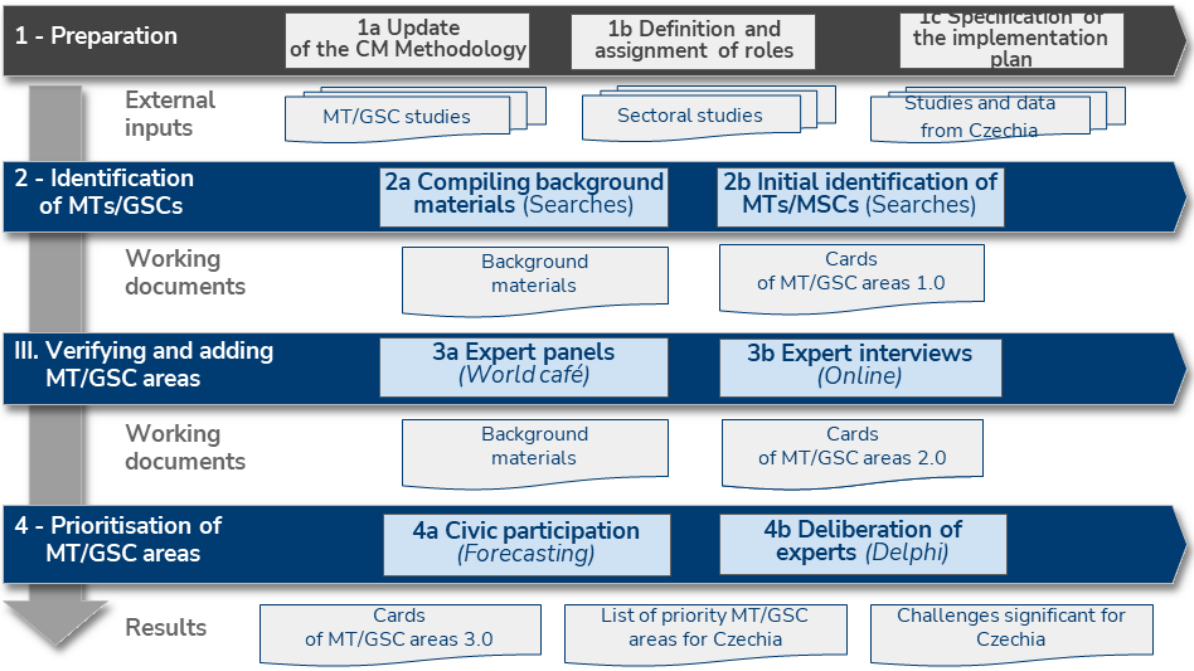

Diagram 1 - General framework of the CM Methodology

The main input for Phase 1 - Preparation is the specifications and organisational arrangement of the project by the contracting authority. Separate steps in Phase 1 - Preparation are 1a - Update of the CM Methodology, 1b - Definition and assignment of roles, and 1c - Specification of the implementation plan. The output of that Phase are organisational documents for implementing Phases 2 - Identification of MTs/GSCs, 3 - Verifying and supplementing the MT/GSC areas, and 4 - Prioritising the MT/GSC areas.

The input for Phase 2 - Identification of MTs/GSCs are secondary data. This Phase makes use of search methods (see Chap. 2a - Compiling support materials and 2b - Initial identification of MTs/GSCs). The output of Phase 2 - Identification of MTs/GSCs and also the input for Phase 3 - Verifying and supplementing the MT/GSC areas are cards of MT/GSC areas 1.0, together with the support materials for their prioritisation. The structure of the cards of MT/GSC areas is specified in Chap. 2b. The situation in Czechia with regard to the MTs/GSCs is one of the points in the card structure, which makes it possible to take into account local situation in prioritising the MT/GSC areas that are global in nature. Phase 3 - Verifying and supplementing the MT/GSC areas follows on from Phase 2 - Identification of MTs/GSCs and develops the cards of areas into version 2.0 which serve as inputs for Phase 4 -

Prioritising the MT/GSC areas. The main approaches are a workshop of experts carried out by means of the world café method (see Chap. 3a) and personal interviews with experts (see Chap. 3b).

The core of Phase 4 - Prioritising is the deliberation of experts carried out using the Delphi method (see Chap. 4b). A separate input for Delphi, apart from the cards of MT/GSC areas, are the results of civic participation implemented by means of the crowd-forecasting method (see Chap. 4a). The outputs are consolidated in the final Phase 4c. The output of Phase 4 - Prioritising are the cards of MT/GSC areas in their final form, a list of priority MT/GSC areas for Czechia and a list of challenges for each of the areas.

1 - Preparation

The purpose of Phase 1 - Preparation is the organisational arrangement of implementing the CM Methodology. The first part of the preparation is managed by the contracting authority and concerns administrative arrangements of the CM Methodology implementation, setting the goalposts of the project. The second part of the preparation is managed by the Promoter. It consists in building the team and developing documents for organisational arrangements of implementing the CM Methodology. The compiled documents introduce the project to the participants, and that makes it possible to involve all the needed partners effectively.

1a - Updating the CM Methodology

The CM Methodology is designed to be used repeatedly, as required by the contracting authority. The purpose of this step is to update and/or specificy the CM Methodology so that it can serve its intent in the best possible way and can use the possibilities available for achieving that intent most effectively. Chapter 3 sets out the recommended directions of development and update of the CM Methodology. The output of this step is a detailed description of the CM Methodology in a new, updated version.

1b - Definition and assignment of roles

To fulfil its purpose, the CM Methodology assumes that its implementation will involve many partners in various roles. The purpose of this step is to clarify and agree on the responsibilities of all participating entities to coordinate the activities. Table 1 below shows the roles in the project. It is likely that some roles will be taken up or even defined only during the project implementation as needed. The project requires both the promoter and the contracting authority to enable such flexibility in assigning the roles.

Role	Definition and responsibilities
Promoter	Organisation responsible for implementing the CM Methodology. It is desirable that the promoter has an extensive network of contacts across fields (ideally covering STEEP-V), which will support the successful implementation of the Methodology. The key aspect is credibility of the promoter, which will enhance its ability to address and involve other experts and will motivate the partners to accept the results.
Project manager	Responsible for implementing the CM Methodology. It is desirable that this person has competences in traditional and agile project management, knowledge of the principles of MTs/GSCs and foresight (see Table 3), the ability to work with academic sources as well as the skill to work on an interdisciplinary basis. As the job involves cooperation with a high number of partners, it strongly requires communication and soft skills.
Project team	The main responsibility is identifying, reading through and interpreting (sense-making) the findings from literature on MTs/GSCs, proposing the MT/GSC areas and making an initial proposal of the content points in the structure of the cards of MT/GSC areas. Also organising the participative methods (world café workshop, forecasting tournament, deliberation of experts in Delphi) and analysing the quantitative and qualitative inputs. It is desirable that the group is diverse in terms of expertise (ideally representing all STEEP-V categories) and gender-balanced. The project team is needed to ensure a broad scope of the project. The key competences include knowledge of the principles of MTs/GSCs and foresight, the ability to work effectively with expert studies, and analytical and organisational skills.
Author of an MT/GSC area card	A project team member responsible for drawing up a certain MT/GSC area card and for communicating with the relevant expert supervisor.
Expert supervisor of an area	An expert who is a member of the Promoter team and has relevant expertise for a given area of megatrends and grand societal challenges. In Phase 2b, this person is responsible for the final content of the MT/GSC area card that he/she supervises. It is desirable that the representation of male and female supervisors is balanced.
Expert team	A group of expert supervisors and other experts. The expert team is needed to ensure the depth of the project. It is desirable that the group

	is diverse in terms of expertise (ideally representing all STEEP-V categories) and that each area is covered by both male and female experts in the expert team. The organisational setting of the project must enable the positions to be filled flexibly as needed.
A wider panel of experts	Experts who are not part of the internal team of the Promoter and provide pro bono expert consultations on the content of the cards of MT/GSC areas in Phase 3 - Verifying and supplementing the MT/GSC areas. Their main responsibility is to discuss professionally and refine the content of the cards of MT/GSC areas.
Moderators	A group of trained facilitators who lead the thematic expert discussions at round tables in the world café workshop in Phase 3a. Their key competence is experience with leading expert discussions and the ability to hold a neutral position.
Recorders	A group of trained recorders who take minutes at the round tables in the world café workshop in Phase 3a. Their key competence is professional interest in the recorded area, which ensures a quality record.
Technician	Responsible for technical support of the participative methods in Phases 3 and 4. This requires IT competences.
Experts in Delphi	Experts who take part in Delphi. The main responsibility is the fulfilment of Phase 4b. The criteria for experts in Delphi are specified below.
Expert editor	Is responsible for linguistic revisions of the texts on the cards of MT/GSC areas and of the overall project outputs.
Graphic designer	Is responsible for the graphic design of the cards of MT/GSC areas so that they are as functional and user-friendly as possible.
Communication support	Project manager assistant who helps with communication towards the stakeholders.
Translator	Responsible for translating the cards of MT/GSC areas and project outputs into English.

Table 1 - Definition of roles in the CM Methodology

1c - Specification of the implementation plan

The purpose of this step is to ensure a general agreement of the participants on the course of the project and to enable capacity planning. The implementation plan depends on step 1a - Update of the CM Methodology. A general recommendation is that at least 9 months are allocated for implementing the CM Methodology (a general schedule is provided in Table 2 below). The background research for the CM Methodology has found comparable foresight projects that mostly took 1-2 years. Sufficient time is needed to cover the broad scope of the project and to ensure a high quality of the outputs. A necessary part of the process are iterations and consultations with a wide range of partners, which require an adequate period.

Phase		**Duration**
1 - Preparation		2-3 weeks
2 - Identification of MTs/GSCs	2a - Compiling support materials	1-2 weeks
	2b - Initial identification of MTs/GSCs	12-14 weeks
3 - Verifying and supplementing the MT/GSC areas	3a - Expert panels (world café)	6-8 weeks
	3b - Expert interviews	2-4 weeks
4 - Prioritising the MT/GSC areas	3a - Civic participation	4-6 weeks
	3b - Deliberation of experts	4-6 weeks
	3c - Consolidation of the output	2-3 weeks

Table 2 - General schedule

2 - Identification of MTs/GSCs

The purpose of Phase 2 - Identification is to create the cards of MT/GSC areas 1.0, which will serve as background material for Phase 3 - Verifying and supplementing the MT/GSC areas, and 4 - Prioritising. The key strategy for implementing this phase is utilising the existing, globally recognised studies and synthesising them into cards of MT/GSC areas.

2a - Compiling support materials

The purpose of this step is to compile a package of support materials that will help the participants to find their bearings in the project and will induce the way of thinking necessary for effective participation. The way of thinking, or mindset, needs to be focused on considering a distant future and values frameworks.

The support materials include[8]:

- Glossary: Explanation of basic terms such as foresight, megatrends or grand societal challenges. The aim is to inform all participants about the definitions used so that the participants can ask questions or offer their critical opinion on them. The glossary is set out in Table 3 below. More information on the definitions is provided in the Background Research for the CM Methodology.
- Summary of the CM Methodology: 1-2 page document outlining the main phases of the Methodology including a link to the full text of the Methodology. The aim is to inform all project participants about the project intent, the whole procedure and the methods used.
- Normative frameworks for the prioritising: A document summarising the key values frameworks that provide guidelines on what state of the future is considered desirable (quality of life, resilience, sustainable development).
- Materials for a broader scope of reflections on the future: philosophical materials on the relationship of humanity to the future (e.g. Hejdánek or Němec), materials on so-called weak signals and wild cards (e.g. World Economic Forum Strategic Intelligence, UK Parliament POSTnotes), materials on thinking about the future in Czechia (e.g.. Civilizace na rozcestí (Civilization at the Crossroad))
- The current state of Czechia: overarching information sources providing a general idea of the state of Czechia (OECD Economic Surveys, European Semester country report).
- Technology trends: overarching information sources providing a general idea of the scope and radicality of new technologies (TC of CAS, JRC, NATO).

The support materials were compiled in an overview that briefly presents all the materials and serves as a signpost to primary sources. The overview of support materials enables a fast orientation in the project context. The overview of support materials is shared with everyone who takes part in the project.

[8] The materials in brackets are those relevant at the time of the CM Methodology pilot implementation. They need to be updated.

Table 3 below sets out the basic terms used in the CM Methodology implementation. For more on the terms and for references to the relevant literature see the Background Research for the CM Methodology.

Term	Explanation
Foresight	The process and a set of methods enabling systematic consideration of the possible options of future development.[9] [10]
Megatrend (MT)	Megatrends are relatively slow and certain directions of development, identified at the global level, and expected to change the face of the world substantially in the next decades.[11]
Grand societal challenge (GSC)	A cluster of problems requiring collective action for their solution in the future.[12]
Weak signals	Indications of future development that have not been identified in mainstream literature so far but the potential development of which can be significant in the next decades.[13]
Wild cards	Surprising and unlikely events and situations with potentially far-reaching consequences.[14]
STEEP-V	The STEEP-V framework is used to define areas when analysing the external environment. The acronym means: society (S), technology (T), economy (E), the environment (E), politics (P) and values (V).[15]
World café	A participative method enabling panel discussions led by facilitators around thematically focused "café tables".[16]
Forecasting	A participative method for informed estimates of future

[9] Miles, I., Saritas, O., Sokolov, A (2016). *Foresight for science, technology and innovation*. Springer International Publish.
[10] Pazour, Pokorný, Valenta (2017). *Foresight - an effective tool of public administration.* Technology Centre of the Czech Academy of Sciences (TC of CAS).
[11] OECD (2016). A*n OECD Horizon Scan of Megatrends and Technology Trends in the Context of Future Research Policy.*
[12] ERA (2008). *Challenging Europe's Research: Rationales for the European Research Area*. European Commission.
[13] Saritas, O. Smith, J. E. (2011). The Big Picture – trends, drivers, wild cards, discontinuities and weak signals. *Futures*, 43(3), 292-312.
[14] ibid.
[15] Smith, S. (2020). *How to Future*. Kogan Page.
[16] Fouché, Light (2010). An Invitation to Dialogue: 'The World Café' In Social Work Research. *Qualitative Social Work*, 10(1), 28-48.

	developments, events, trends or outputs.[17]
Delphi	A method for structuring a collective deliberation, based on iterations and anonymity of participants.[18]
Quality of life (Well-being)	Qualitative parameters of human life, way of life, lifestyle, standard of living and living conditions of the society.[19]
Resilience	Ability to face adverse forces and future crises.[20]
Sustainable development	Development that meets the needs of current generations without compromising the needs of future generations.[21]

Table 3 - Glossary

2b - Initial identification of MTs/GSCs

The aim of this phase is to draft the cards of MT/GSC areas 1.0, which will be subsequently discussed at the world café and in individual consultations in Phase 3 - Verifying and supplementing the MT/GSC areas.

2b.1 - Compiling a corpus of MT/GSC studies

The input for MT/GSC identification is MT/GSC studies. The basic criteria for their inclusion are: explicit focus on MTs and/or GSCs, authored by an authoritative source and published in the last 5 years. Based on those criteria, a corpus of studies will be compiled and their analysis will yield an identification of MTs/GSCs at global and regional (EU) level. Based on the Background Research for the CM Methodology, we can formulate basic recommendations for selecting the sources:

- diverse types of authoritative sources and views of the world,
- a time horizon relevant for the needs of the research (10 to 30 years),
- sources focused in general on MTs/GSCs with varying levels of scope and specialisation,
- studies with a transparent methodology,
- ideally using participatory methods.

For the needs of the CM Methodology, the authoritative sources are studies published by:

- academic centres,
- international and multinational organisations: EU institutions, organisations in the system of the UN, OECD, NATO,
- governments and national organisations of OECD and G20 member states,
- multinational corporations and private entities in the field of foresight, MTs and GSCs
- renowned non-governmental non-profit organisations.

[17] Tetlock, P., Mellers, B., et al. (2014). Forecasting tournaments: Tools for increasing transparency and improving the quality of debate, *Current Directions in Psychological Science*, 23(4), 290-295.
[18] Linstone, H., Turoff, M. eds (2002). *The Delphi Method - Techniques and Applications*.
[19] OECD (2020). *How's life 2020: Measuring Well-being*.
[20] European Commission (2020). *2020 Foresight Strategic Report.*
[21] UN. *Sustainable Development Goals 2030.*

To identify the relevant studies, two strategies can be applied: The first lies in identifying one or more studies that use their own corpus of MT/GSC studies, and recording their sources. In the pilot implementation of the CM Methodology, the studies were: CIMULACT (2018), Sami Consulting (2020), Oxfam (2020). Those three studies were carried out in diverse sectors and have different focuses, i.e. they indicate different sources.

A complementary strategy is a targeted search on the websites of the institutions that regularly publish such studies. These are mainly international organisations such as the UN and OECD, national governments and ministries, academic centres and other organisations (e.g. SITRA, NESTA, Fraunhofer ISI), transnational corporations and consulting firms as well as organisations active in the field of Future studies (Association of Professional Futurists, World Futures Studies Federation, World Future Society, Future of Humanity Institute, Futuribles International). It is also possible to use the catalogue of sources, available on the website of ESPAS Knowledge base.

The corpus of studies is then converted to a database format (e.g. in a spreadsheet editor), indicating basic information on the study and the publishing organisation.

2b.2 - Synthesis of the MT/GSC studies

The purpose of this step is to understand the content provided in the MT/GSC studies and to assess it critically. The project team gradually reads through and interprets the MT/GSC studies included in the corpus of studies. The key activity here are ongoing discussions in the project team about the relevance of the information, its content points and level of detail. For the management of this phase, it is key to monitor the process of discussions and the way they are conducted so that the high diversity and comprehensiveness of input information sources are respected and so that the project team can gradually comprehend the content of the MTs/GSCs. Minutes are taken of the discussions to record all inspiring observations (not all can be given immediate attention), which applies to the next steps of this phase too.

The result is a working overview of MTs/GSCs identified in the foresight studies (in a text document or in a spreadsheet) where the information from the studies is provided with the sources indicated. It is advised to structure the document according to the structure of the cards of MT/GSC areas (see 2a.5).

2b.3 - Drafting the thematic definition of MT/GSC areas

The MT/GSC studies work with various conceptualisations of MTs and GSCs. The purpose of this phase is to propose the number and thematic focus of the cards of MT/GSC areas. The first step is to remove duplications in the working MT/GSC overview where the MTs/GSCs are grouped based on their similarities. The result are clusters of MTs/GSCs that are similar in topics and content but are sufficiently mutually different (internal homogeneity and external heterogeneity of the group) so that overlaps are minimised.

The clusters of thematically similar MTs/GSCs are assigned to STEEP-V areas, which also serves as a verification of completeness. Some MTs/GSCs may be assigned to multiple STEEP-V areas. In such case, it is necessary to select primary and secondary STEEP-V areas. Then, further iterations of the clustering are undertaken. To cluster the MTs/GSCs, it is suitable to hold 2-3 internal workshops of the project team. The output of the MT/GSC clustering is a list of MT/GSC areas to be processed on the cards, and a thematic definition of the areas.

2b.4 - Nomination of expert supervisors and the final thematic definition of the MT/GSC areas

The purpose of this step is to review and specify the list of MT/GSC areas and to select an expert supervisor for each area. If it is necessary to cover other areas that were not envisaged when starting the project, the project team finds and contacts the relevant experts.

The project team informs the expert supervisors about the project details, provides them with documents created in Phase 1 - Preparation and with support materials, and discusses the materials with the experts during a seminar. The support materials are key. The project team also presents the list of MT/GSC areas and the working MT/GSC overview. The next step is a joint discussion of the list of MT/GSC areas, specification of their definition and any other modifications to the MT/GSC clustering.

The output of this step is the final list of MT/GSC areas and an expert supervisor nominated for each of the areas.

2b.5 - First draft of the cards of MT/GSC areas

The purpose of this step is to define the content of the MT/GSC areas and to ensure the team members are informed. One author is selected from the project team for each card. The author contacts the expert supervisor and together they agree on the content points of the paragraphs on the card, these form the headings before more detailed content is drafted.

After that, the project team and the expert supervisors discuss the scope of the topics on the cards. The aim is to avoid repeating information. In this phase, it is still possible to modify the list of MT/GSC areas and the content points on the cards (iteratively). The purpose of the discussion is to make sure that the authors and expert supervisors know what will be included in the other cards.

The output of this step is the first draft of the cards containing only the content points - headings of the paragraphs in the card structure set out below in Table 4.

Title on the card	Contents
Developments to date	Statistical data on historical development
Future prospects	Expected development in the next 10 to 30 years
Expected impacts and related future challenges	Estimated impacts Challenges and opportunities arising from the likely impacts
Global and European goals	Goals adopted at global and European level (SDGs, EU 2050,...)
Possible directions for solutions	Solutions having the potential to mitigate the impacts Partial solutions for the identified challenges
General overview of the situation in the Czech Republic	Statistical indicators Local impacts in Czechia, if they are directly addressed by existing academic or publicly available grey literature

Table 4 - The structure of the cards of MT/GSC areas

2b.6 - Compiling a corpus of sectoral studies

The purpose of this step is to keep record of the information sources that will make the content points set out on the cards of MT/GSC areas more specific. Such specificity is provided by sectoral studies. The criteria for selecting the sectoral studies are similar to those for compiling the corpus of foresight studies. The sectoral studies do not necessarily focus on future developments.

One possible strategy for identifying the sectoral studies is to use references contained in MT/GSC studies. It is also possible to consult comprehensive libraries of sources, such as ESPAS Orbis or JRC Megatrends Hub.

The second strategy are targeted searches on the websites of authoritative institutions, mainly international and transnational organisations (UN, OECD, EU, World Bank, IMF, Council of Europe, WTO...), international non-governmental organisations (Oxfam, Amnesty International, WWF...), publications of national or local governments (EU member states, G20 countries…), publications of renowned consulting firms (E&Y, KPMG, PwC, Deloitte, McKinsey & Company...) and academic publications in scientific journals (available through search engines Google Scholar, Scopus, Web of Science).

The third strategy is a general search for publications through internet search engines (e.g. Google Scholar, databases of scientific articles such as Scopus and Web of Science). Such search may bring a high number of results, so we recommend setting a time specification together with search operators.

The corpus of sectoral studies is stored in a database with basic information on each publication (similarly to the corpus of foresight studies). The corpus of sectoral studies is continuously supplemented in line with the gradual modification and supplementation of the text on the cards of MT/GSC areas in step 2a.7.

2b.7 - Cards of MT/GSC areas 1.0

The purpose of this step is to supplement the proposed cards of MT/GSC areas with information contained in the publications focused on specific topics and areas. A card is drawn up for each MT/GSC area in the structure described above. The content of the cards of MT/GSC areas is formulated considering possible uncertainty. The cards of MT/GSC areas are around 8-10 pages (A4 size) long. The aim is to make the cards comprehensible also for an informed lay person in the given area, which is necessary for the prioritisation that will be carried out by a group of experts from various fields.

The card author draws up the paragraphs and continuously consults their content with the expert supervisor. The supervisor may identify unclear issues and inconsistencies or incomplete information (mainly contextual) in the content of the paragraphs. The expert supervisor in cooperation with the expert team may search for and supply references to sectoral studies relevant for drawing up the MT/GSC area card and such sectoral studies are added to the corpus of sectoral studies.

Inputs for the General Overview of the Situation in Czechia are obtained from country reports of transnational and international organisations, from analytical parts of Czech strategic documents and other data sources. The main sources here include:

- EU, OECD, IMF, World Economic Forum,
- UN, SDG index,
- World Happiness Report / Global Happiness and Well-Being Policy Report,
- Czech Statistical Office and EUROSTAT.

The process of compiling the cards of MT/GSC areas consists of several iterations based on discussions between the expert supervisor and the card author so that changes can be made even during the card compilation. The output are cards of MT/GSC areas 1.0.

2b.8 - Editing and graphic design of the cards of MT/GSC areas 1.0

The purpose of this step is to prepare the cards of MT/GSC areas for use in Phase 3. First, the texts are edited from an expert point of view and their linguistic intelligibility is checked, then the cards are graphically designed to be functional and user-friendly. The output are linguistically and graphically finalised cards of MT/GSC areas 1.0.

3 - Verifying and supplementing the MT/GSC areas

The aim of this step is to specify the content of the MT/GSC cards 1.0 produced in step 2b - Initial identification of MTs/GSCs. The output will be the final version of the cards of MT/GSC areas. The created cards 2.0 will be the main input for Phase 4 - Prioritising.

3a - Workshop (world café)

The purpose of this step is to obtain expert feedback on the cards of MT/GSC areas 1.0 and enable interaction between the participating experts. To achieve that, the world café method was chosen. The basic principle of world café is discussion in small groups at "café tables" where each table has a thematic focus based on the cards of MT/GSC areas. Each table is attended by several participants (experts), a moderator (or also the author of the given MT/GSC area card) and a recorder. The discussion runs in rounds that have a pre-defined duration (usually 20-30 minutes). After the round ends, the participants go to another table.

For each MT/GSC area, the project team makes an analysis of relevant fields of expertise and compiles their list, then in cooperation with the contracting authority, the team finds a total number of 40-60 experts covering various fields so that each MT/GSC area is covered by at least 3 experts (one expert may have relevant expertise for more than one area). The recruitment should be made at least a month in advance.

Strategy for the recruitment:

- Nomination by the project team (desk search, network)
- Nomination by the contracting authority
- Nomination by the expert team
- Any other nominations by participating experts
- Public call

After obtaining the nominations, a triangulation is made - an expert should ideally get three independent nominations or confirmations of their nomination from multiple parties. The project team finally confirms the nominations based on criteria described below.

The composition of experts ideally meets the following recommendations:

- There are experts from academia, the public sector, the private sector and the non-profit sector.
- The group is heterogeneous at least in terms of gender and age, and ideally in terms of geographical coverage.
- Together, the experts cover a wide range of fields (it is possible to start from the STEEP-V framework and specify it further e.g. by means of the FORD classification).
- The experts have demonstrable interest and ability to deliberate the future that is characterised by uncertainty and complexity.
- Ideally, each expert has knowledge in multiple fields or their research or professional activities are interdisciplinary in nature.

Subsequently, the project team contacts the identified experts offering them cooperation in the world café.

The potential participants who have confirmed participation receive the cards of MT/GSC areas 1.0 before the workshop and fill in their thematic preferences in a questionnaire. Several days before the workshop, the project team sets up the discussion tables based on the preferences, but to for the tables to be balanced, not all participants will be satisfied in their preferences. The team will send out the cards of MT/GSC areas 1.0 and a link to the online platform to which the participants will connect, and a list of tables at which they will join the discussion. Each MT/GSC area card will be discussed at least at one table. Based on the number of topics and participants, each card of an MT/GSC area can be discussed at multiple tables or one table can be dedicated to more than one card.

Before the workshop, the project team organises a coordination meeting with the moderators and recorders.

During the world café, each table is attended by one moderator and one recorder who remain at the same table for all rounds. Moreover, each table has a pre-defined number of participants. At the beginning of each round, the moderator informs the participants at the table about the main points concerning the given MT/GSC area and about the main outputs from the previous rounds.

The world café is opened with a presentation of the project and its purpose (15-20 min.), followed by rounds of discussion over the cards of MT/GSC areas. The world café is concluded by a discussion (around 20 min.) in groups on thematic definition of the MT/GSC areas. Two or three rounds can take place during one afternoon. One round lasts 30-40 minutes (can be adjusted based on the number of participants). At the start of each round, the participating experts have approx. 10 minutes to get acquainted with the cards of MT/GSC areas that will be discussed.

Questions for the discussion of MT/GSC areas:

- Question 1: Is the content scope of the card defined adequately? Which sub-theme should be excluded from the card? Which sub-theme is missing in the card?
- Question 2: The previous discussion (on Question 1) produced the following recommendations (the moderator lists them). Do they include a recommendation you disagree with or you wish to support?
- Question 3: Would you add any factual information to the first sections of the card? Can you indicate the information source?
- Question 4: Would you add any factual information to the section on Czechia? What sources of information do you suggest to add to the situation in Czechia?

Question for the final discussion on the thematic definition of the MT/GSC areas:

- Question 5: Do you have any recommendations concerning the definition of the MT/GSC areas and the overall composition of the cards?

3b - Individual consultations (interviews)

The purpose of this step is to supplement and specify the information in the draft cards of MT/GSC areas and give the world café participants and other experts an opportunity to take a greater part in creating the cards of MT/GSC areas. In this phase, it is also possible to consult experts who could not participate in the world café. The output is a record of the expert interview, either as comments or in a separate document.

The card author contacts the experts who are interested in further cooperation and agrees on a date for consultation (30-60 minutes). The author also sends them an editable working document with the full text of the card. During the consultation, the card author can discuss specific points or ask the same questions as in the world café.

3c - Processing cards of MT/GSC areas 2.0

The purpose of this step is to extract the obtained expert inputs from the world café and expert interviews and integrate them into cards of MT/GSC areas 2.0. The card author in collaboration with the expert supervisor and the expert team processes the cards of MT/GSC areas, the expert supervisor makes a final check.

In the next step, the content of the cards is provided to the expert editor for proofreading and then to the graphic designer for typesetting and final graphic design of the content.

4 - Prioritising the MT/GSC areas

The purpose of Phase 4 - Prioritising is to determine which MT/GSC areas should be preferentially the focus of research in Czechia, mainly in SSHA, and potentially also where to direct attention in other areas of public decision-making. The aim is to identify areas where investment and activities have the highest potential to maximise the future societal benefits or minimise the identified adverse impacts on the quality of life in Czechia.

The prioritising will be carried out in two consecutive steps. First, civic participation will be applied through the forecasting method and then deliberation of experts will take place using the Delphi method.

The outputs of this Phase are the priority MT/GSC areas for Czechia and arguments for their prioritisation.

4a - Civic participation (Forecasting)

The aim of this step is to create a set of inputs from a the general public in order to enrich and diversify the background documents that are subsequently provided to experts before starting the prioritisation through Delphi.

For these purposes, a crowd-forecasting tool is deemed relevant. Such tools have two main aspects that must be met in this Phase: (1) broader participation, and (2) forecasting. Another two recommended aspects are: (3) iterative discussion of participants, and (4) sufficient motivation to take an active part.

> (1) The aspect of broader participation opens the decision-making to more innovative and unconventional inputs that would otherwise not be formulated for various reasons either by the world café workshop participants or by experts in Delphi. For this purpose, it is appropriate to target the recruitment of participants at higher education students and doctoral students across all fields. They should be asked about their own opinion and be given space to justify their opinions.
>
> (2) The aspect of forecasting is meant to encourage discussion on the possible cognitive limitations of the experts and so reduce the risk that the decision-making of the experts in subsequent Delphi will be distorted by their conventional views or personal interests. To that end, it is advisable to ask the participants about their prognoses of the Delphi results as well as provide space for formulating the expected undesirable distortions of the expert opinions or other possible deficiencies of the subsequent Delphi.
>
> (3) The aspect of iterative discussion is important to support mutual discussion of the participants and so increase the overall quality of the outputs. For this purpose, we recommend using real-time online forecasting platforms where the participants see the opinions and predictions of the others, can respond to them, and modify their own inputs

based on the opinions of others and so build together a "database" of relevant arguments and sources.

(4) We recommend supporting the motivation of participants to dedicate significant amount of time to preparation and to elaborate arguments with tools such as tournaments or contests. Financial motivation can also be used to reward the best text inputs and/or best predictions of the future outputs from Delphi. The probability of the Delphi results, expressed as a percentage, can serve as an appropriate indicator of the input quality based on which the participants can be rewarded.

More information on forecasting is provided in the Background Research for the CM Methodology.

4a.1 - Recruitment and platform

Participants are recruited from the general public. The recruitment is actively targeted at young participants studying or having completed tertiary education. The request to spread information about the recruitment is distributed to all public higher education institutions in Czechia, ideally also to other educational institutions and other relevant organisations active in the academic sector. There should be at least 200 registered participants to achieve, on a non-selective basis, a sufficiently diverse group in terms of sectors, gender and regions.

The participants are informed about the purpose of civic participation in the project of the CM Methodology implementation. It is also appropriate to introduce the participants to the fundamentals of forecasting and work with probabilities before starting their participation. Active participation in such a workshop or online training can serve as a suitable tool to select applicants with sufficient motivation[22].

A suitable platform will be selected, enabling an effective fulfilment of the aspect of broader participation and the aspect of forecasting, and ideally also enabling the iterative discussion of participants and other recommended aspects (mainly the financial motivation and rewarding of participants)[23].

4a.2 - The forecasting procedure

Before the start, the participants must be informed about the rules and the precise formulation of the questions in the subsequent Delphi. In this phase, the participants should not know the identity of the experts in Delphi. Also before the start, the participants should be instructed to use anonymous nicknames on the platform to eliminate social pressure.

The participants will choose which MT/GSC areas they would personally prioritise, if they were in the position of the experts, and will explain why. The participants must be aware that their argumentation

[22] The pilot implementation of the CM Methodology used a group of 238 participants who had taken part in similar forecasting tournaments in other research projects.
[23] The CM Methodology piloting used an online forecasting platform (specifically the platform provided by the Cultivate Labs organisation).

will be anonymously provided to the experts for Delphi and so it can influence their judgement. It will be proposed that the most frequently marked priorities are given greater attention in Delphi[24].

The participants will then be instructed to answer the question "Which of the following areas will rank in the first X places of the ranking produced by the answers of experts in Delphi?". The participants will determine for each area, with what probability they expect that area will be among the X[25] selected priorities, and they can provide any text comment. Throughout the exercise, the participants can debate with the other participants on the platform and modify their predictions[26].

4a.3 - Summary of the results

Analysts process all the inputs. Any inspiring textual inputs from all participants on both questions will then be provided to the experts as background material for decision-making in Delphi. If financial motivations are used, the best predicting and/or commenting participants should be publicly announced after the Delphi ends, and then the financial rewards should be distributed[27].

4b - Deliberation of experts (Delphi)

The purpose of this step is to determine the priority MT/GSC areas that are significant for Czechia, to identify the arguments for that prioritisation and compile a list of challenges significant for Czechia. Each expert will individually evaluate the MT/GSC areas based on repeated interaction with the other experts.

The deliberation of experts will be carried out using the Delphi method. In three rounds, the group of experts prioritises the MT/GSC areas that are, in their expert opinion, significant for Czechia (in terms of potential impact on the quality of life in Czechia) and formulates arguments justifying their conclusions. The criteria for assessing the significance are defined in advance based on a normative framework described in the support materials.

4b.1 - Compiling the expert group for Delphi

It is a group of approximately 25 experts. The composition of experts ideally meets the following recommendations:

- The group is heterogeneous in terms of expertise so that all STEEP-V areas are evenly covered[28].

[24] In the CM Methodology piloting, a question was asked about the prediction of the opinion of the whole group of participants.
[25] In the CM Methodology piloting, X = 6.
[26] In the CM Methodology piloting, the phase of broader participation lasted 18 days.
[27] In the CM Methodology piloting, the evaluation was based on the Brier score. Out of 50% of participants with the best score, 15 were drawn by lot and rewarded with a voucher worth CZK 1500.
[28] The fields of expertise of experts in Delphi according to STEEP-V and FORD classification:
- Society: Psychology and cognitive sciences, Educational sciences, Sociology, Social and economic geography, Media and communication, Other social sciences, Medical and healthcare sciences
- Technology: Engineering and technologies, Computer and information sciences
- Economy: Economics and business, Mathematics

- The composition of the group is heterogeneous at least in terms of gender and age, and various institutions are represented.
- The experts have doctoral degrees or at least 5 years of experience in the field.
- Some of the experts are specialised in several fields or are capable of interdisciplinary work.
- The experts have demonstrable interest and ability to deliberate the future that is characterised by uncertainty and complexity.
- The experts have moral credit.
- The experts are able to work with the key aspects of the prioritisation (normative frameworks of the quality of life, sustainable development and resilience).

The experts for Delphi are identified through the same mechanism as for the world café workshop (see Chapter 3a). The identified experts are addressed in a personal invitation to participate in Delphi. A situation where an expert has expertise only for some MT/GSC areas while their expertise for other MT/GSC areas is limited is accepted as normal. The process of answering (see below) and the iterative mechanism of Delphi enabling an informed opinion to be provided on all MT/GSC areas are generally explained. The experts then receive materials produced in Phase 1 - Preparation and support materials, and those documents are discussed with the experts.

4b.2 - Preparation of Delphi

Before the Delphi exercise, the experts registered for Delphi receive instructions that are then explained at online or personal meetings. This includes information about the Delphi process, the platform used, the cards of MT/GSC areas and outputs of the forecasting tournament, requirements for the qualitative explanation of opinions, the assumptions used for the prioritisation[29] and the process of answering (see below). The experts are invited in the instructions to use the principles of multi-criteria analysis based on normative frameworks of the quality of life, set out in the support materials.

Before starting Delphi, a questionnaire is sent out to the participants to collect socio-demographic characteristics and information on the areas and level of expertise. The socio-demographic characteristics must at least contain the age category, gender, the highest educational achievement, the sector of professional activity, the field specialisation (according to the FORD classification) and the level of expertise for each MT/GSC areas. The evaluation of the questionnaire is then displayed in the Expertise Matrix (the Expertise Matrix template is provided in Annex 1). The project team undertakes to handle personal data of the participating experts responsibly in line with GDPR. The

- Environment: Physical sciences, Chemical sciences, Earth and related environmental sciences, Biological sciences, Other natural sciences, Agricultural and veterinary sciences
- Politics and geopolitics: Political sciences, Law, Sociology
- Culture and values: History and archaeology, Languages and literature, Philosophy, ethics and religion, Art, Other humanities

[29] The assumptions used for the prioritisation are formulated in cooperation with the contracting authority. For example, in the CM Methodology pilot implementation, the following assumption was used for Question 3: "In question "SSHA support", please assume that it is within the means of Czech science to address the expected impacts and challenges from the given MT/MSC area. I.e. assume the general solvability by research, development and innovation."

Expertise Matrix contains personal data on the participants. Before dissemination, the data should be aggregated and anonymised.

Together with the questionnaire, the participants receive a document with an ethical commitment, in which they write their name and express consent with the following text:

> In Delphi under project "Megatrends and grand societal challenges", I will proceed to the best of my knowledge and conscience. I will not favour my personal interests nor the interests of my institution. I will act with utmost impartiality and with an honest interest in achieving the goal of Delphi to ensure the quality of life in Czechia in the future decades.

Each of the experts in Delphi receives access to background materials and answer forms (see Annex 2) based on the selected technical platform for Delphi. The project team ensures mutual anonymity of the Delphi participants.

4b.3 - The first round of Delphi

In the first round, each expert provides individually, in writing and anonymously an answer on prioritisation of the MT/GSC areas and justification for prioritising or not prioritising each of the MT/GSC areas. The answers use a four-point scale: definitely no, rather no, rather yes, definitely yes[30].

- Question 1: Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades."
  - Arguments to explain the answer.
- Question 2: Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it."
  - Arguments to explain the answer.
- Question 3: Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA."
  - Arguments to explain the answer.

The justifying comment explaining the answer is about a half of a standard page long (around 700-1300 characters with spaces) for all three questions together.

The inputs of the experts are sent to the project team only. The aim is to reduce the self-moderation bias. At the end of the first round, the project team analyses the inputs from the first round of Delphi. All inputs from the experts in Delphi (primary data) are restructured to create overviews of all expert inputs in the first Delphi round for each MT/GSC area. For each of the outputs, information is provided on the level of expertise for the MT/GSC area, obtained from the initial questionnaire. For the quantitative questions, an overview of the results of the first Delphi round is compiled, the qualitative inputs of arguments are coded and grouped into a list of arguments for each MT/GSC area. The coding

[30] For quantitative processing, the scale can be converted to scores: 0 = definitely no, 1 = rather no, 2= rather yes, 3 = definitely yes.

uses triangulation - it is carried out by at least three members of the project team independently, and the final list of arguments is created subsequently in a discussion of the project team. The overview of expert inputs in the first Delphi round for each MT/GSC area, the overview of results of the first Delphi round and the list of arguments for each MT/GSC area are the background materials for the second round of Delphi.

4b.4 - The second round of Delphi

At least 7 days before starting the second round of Delphi, the experts receive background materials for the second Delphi round from the project team. In the second round, the experts are asked to review, if deemed necessary, their individual selection of the priority MT/GSC areas based on the output of the first round, and are also asked to name the challenges most significant for Czechia.

- Question 1: Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades."
    - If a participant changes their opinion between the rounds, he/she provides arguments for the change.
- Question 2: Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it."
    - If a participant changes their opinion between the rounds, he/she provides arguments for the change.
- Question 3: Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA."
    - If a participant changes their opinion between the rounds, he/she provides arguments for the change.
- Question 4: What expected impacts and challenges in the given area are, in your opinion, the most significant for the future quality of life in Czechia? Please name them.

The answers are again sent to the project team only. At the end of the second round, the project team analyses the inputs from the second round. An overview of all expert inputs in the second Delphi round for each MT/GSC area is compiled (including the level of expertise for the MT/GSC area) as well as an overview of results of the second Delphi round for the quantitative questions. The qualitative inputs of arguments and challenges significant for Czechia are coded again using triangulation. The result is an updated list of arguments and a working list of challenges significant for Czechia. The overview of all expert inputs in the second Delphi round for each MT/GSC area, the overview of results of the second Delphi round, the updated list of arguments and the working list of challenges significant for Czechia are the background materials for the third round of Delphi.

4b.5 - The third round of Delphi

At least 7 days before starting the third round of Delphi, the experts receive background materials for the third Delphi round from the project team. In the third round, each expert gives a final answer for each MT/GSC area. In questions 1-3, the experts have a limited number of points to distribute. That

limit depends on the number of MT/GSC areas and the course of Delphi[31]. The score limit used in the third Delphi round serves an internal validation of the results from the second Delphi round.

- Question 1: Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades." *You have a total of* [limit] *points for your scoring. You can allocate 0 to 3 points to each area. Please distribute all* [limit] *points.*
- Question 2: Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it." *You have a total of* [limit] *points for your scoring. You can allocate 0 to 3 points to each area. Please distribute all* [limit] *points.*
- Question 3: Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA." *You have a total of* [limit] *points for your scoring. You can allocate 0 to 3 points to each area. Please distribute all* [limit] *points.*
- Question 4: If you were to select only exactly 6 areas, which ones would it be? *Choose exactly 6 areas.*
- Question 5: What expected impacts and challenges in the given area are, in your opinion, the most significant for the future quality of life in Czechia? Please name them.

Consolidation of outputs

The aim of this phase is to produce coherent and clearly presented outputs to ensure the best possible user-friendliness for the contracting authority and other users promoting the application of the project outputs. The main outputs are the identified MT/GSC areas and cards of the areas, the priority MT/GSC areas and the list of challenges with a significance for Czechia.

The first main output are the identified MT/GSC areas and cards of the areas, which can be, after Delphi and with consent of the expert supervisor, finally specified based on feedback from participating experts (producing the final version 3.0 of the cards). The identified MT/GSC areas are, at the end, compared with the results of similar projects around the world.

The second main output are the priority MT/GSC areas. A quantitative evaluation of Delphi is made in a table indicating the sums of points received by each MT/GSC area for all quantitative questions. Based on the table, the results are graphically depicted to visualise the differences in the scores of the MT/GSC areas. An evaluation is made of whether the results indicate a logical line in the significance of the MT/GSC areas for a recommendation of the resulting number of priority MT/GSC areas. The overall results for all areas are presented.

The third main output is the list of challenges with a significance for Czechia. The final coding is made for the inputs in Delphi provided for the question of grand societal challenges significant for Czechia for all MT/GSC areas, again using triangulation. The codes are grouped into categories based on similarity, thus producing a list of grand societal challenges with a significance for Czechia. That list is sorted in descending order by frequency and is provided to the experts in Delphi for validation. If the

[31] In the CM Methodology piloting, the score limit of 38 points was used.

qualitative inputs of experts in Delphi include grand societal challenges that are beyond the defined MT/GSC areas, the challenges are indicated.

The output of the consolidation of outputs is the final report containing a summarising comment, the benefits and limitations of framing the future by means of MTs/GSCs, the procedure information including the results of the civic participation, all main outputs and the limitations of the chosen approach. The final report is, together with acknowledgements, shared with anyone who was involved in any phase of the methodology, ideally with information from the contracting authority on the next steps.

Development and update of the CM Methodology

The CM Methodology was designed with regards to the feasibility of its pilot implementation. This part describes the recommended extensions of the CM Methodology for future implementation where greater opportunities are expected e.g. thanks to a longer duration of the project or technological advancement. The recommendations arise from the implemented background research (see the Background Research for the CM Methodology) and from reflection on the pilot implementation of the methodology (See Reflection on the pilot implementation of the CM Methodology). The extensions enable the methodology phases to be elaborated in greater detail. The extensions can form separate follow-up projects.

The extensions include in Phase 2 - Identification of MTs/GSCs visioning and an analysis of weak signals, in Phase 4 - Prioritising the MT/GSC areas an increase in the number of participants in Delphi and the production of scenarios and impact studies.

Visioning

The principle of visioning is creating a shared vision of the future. The purpose of this extension of the CM Methodology is to develop a discussion on the desirable future of Czechia and establish the quality of life, resilience and sustainable development as normative frameworks that are broadly supported. Visioning is carried out using participative methods to involve a diverse range and large number of actors. Apart from its output, an important added value of this extension would be the facilitated process of visioning and inclusion of partners. This could promote thinking about the future in the society and social cohesion.

Analysis of weak signals

Another recommended extension is the use of horizon scanning methods for identifying weak signals of development. Weak signals are indications of future development that have not been identified in mainstream literature so far but the potential development of which can be significant in the next decades.

Horizon scanning can take the form of consultations with qualified experts or the general public through participative methods (focus groups, workshops, expert panels or interviews). The advantage is that this method can cover topics that are not mentioned in the MT/GSC studies. At the same time, there is a risk that the composition of the groups of respondents will influence the final result. The information must be collected continuously and over a long period.

The second option is to use semi-automated methods (big data and text analysis) that enable collection and subsequent structuring of information on a large scale. The advantage is the possibility to process large amounts of data beyond what is humanly possible. One of the ways is identifying important topics based on the number of newly produced scientific publications or the growing number of citations on the given topic. Other possible inputs for the semi-automated horizon scanning include analyses of the media, analyses of patents, analyses of creative works or analyses of strategic

documents. Nevertheless, the semi-automated horizon scanning is limited by the nature and structure of the data entering the analysis, and by that the interpretation of the results requires a long-term involvement of experts.

Increasing the number of participants in Delphi

Another recommended expansion of the CM Methodology lies in increasing the number of persons participating in the prioritisation of MT/GSC areas in Delphi. It would be appropriate to involve further age and social groups. In addition to experts from academia, these may include students, practitioners from the business and non-profit sectors, public officials and civil servants, pensioners etc. Regarding the qualitative nature of the outputs and the demanding processing, we recommend creating multiple parallel groups with around 25 members. Such groups can be heterogeneous or be compiled based on the above categories. Considering the representation of regions should be considered in compiling the groups.

Producing scenarios and impact analyses

In the phase of prioritising the MT/GSC areas, we recommend implementing coherent impact studies of the MTs/GSCs concerning the impact on Czechia. Given the broad thematic scope, effectiveness must be considered in compiling the impact studies. A possible way is to create scenarios of the future, which would define the scope of the intended impact studies.

The creation of scenarios is one of the most used foresight methods that enables reflections on the alternatives of future developments. It often relies on participative methods. Another step is an analysis of impacts of the different scenarios, it can combine various procedures based on deductions of "What if...". It is possible to hold workshops similar to "Megatrends implications assessment" (JRC) or "Mapping Europe's environmental future: Understanding the impacts of global megatrends at the national level" (EEA).

Another approach can be the modelling and simulation of the impacts, with the help e.g. of cross-impact analysis or system dynamics, which take into account causal loops and feedback loops. There are other methods of impact assessment that can be used (e.g. technological assessment, social impact assessment).

Annexes

Annex 1 - Deliberation of experts (Delphi) - Expertise Matrix

Questionnaire

Item	Question	Answers
Surname	What is your surname? (used only to pair the data with the answers)	Free text
Age	How old are you?	20–34 years 35-50 years 51-65 years more than 65 years
Gender	What is your gender?	Man Woman
Highest level of education	What is your highest level of education achieved?	Primary Secondary Graduate Post-graduate (doctoral)
Sector	In what sector do you perform your main professional activity?	Public Administration Private sector Non-profit sector Academic sector
Field specialisation	In which of the fields below do you have formal education or work experience? (you can select more options) - Note: The classification is based on the Frascati Manual 2015 (TA CR).	List of 42 fields (FORD)
Level of expertise by area	What level of expertise do you have in each of the following areas? - Note: These areas correspond to the 18 cards that were compiled as part of searches and synthesis of literature.	I have the relevant expertise I have limited expertise, but I am interested in the topic I know only the general aspects

Template for compiling the Expertise Matrix

Item	Answers	Participant 1	Participant 2	Participant 3...	Summary
ID of the respondent	Surname or anonymised ID				
Age category	20–34 years 35-50 years 51-65 years more than 65 years				
Gender	Man Woman				
Highest level of education	Primary Secondary Graduate (BA/BSc, MA/MSc) Post-graduate (doctoral)				
Sector	Public Administration Private sector Non-profit sector Academic sector				
Field specialisation	Fields from the FORD classification				
Level of expertise by area	I have the relevant expertise. I have limited expertise, but I am interested in the topic. I know only the general aspects.				

Annex 2 - Deliberation of experts (Delphi) - Answer forms

The first round of Delphi

Area	**<u>Question 1</u>: Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades."**	Indicate your arguments, data and other contextual information important for your answer.	**<u>Question 2</u>: Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it."**	Indicate your arguments, data and other contextual information important for your answer.	**<u>Question 3</u>: Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA."**	Indicate your arguments, data and other contextual information important for your answer.	*Space for your working notes*
Area 1	**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		
Area 2...	**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		

The second round of Delphi

Area	**<u>Question 1</u>: Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades."**	Indicate arguments, data and other contextual information in case you have changed your answer between the 1st and 2nd round.	**<u>Question 2</u>: Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it."**	Indicate arguments, data and other contextual information in case you have changed your answer between the 1st and 2nd round.	**<u>Question 3</u>: Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA."**	Indicate arguments, data and other contextual information in case you have changed your answer between the 1st and 2nd round.	**<u>Question 4</u>: What expected impacts and challenges in the given area are, in your opinion, the most significant for the future quality of life in Czechia? Please name them.**
Area 1	**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		
Area 2...	**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		**choose from the offered options** [scale from definitely no to definitely yes]		

The third round of Delphi

Area *You have a total of 38 points for your scoring. You can allocate 0 to 3 points to each area. Please distribute all 38 points. For simplification, we pre-filled the scores based on your answers in the 2nd round using the key "definitely yes" = 3 points and "definitely not" = 0 points.*	**<u>Question 1</u>:** **Do you agree with the following statement? "The area will have a very significant impact on the quality of life in Czechia in the next decades."**	**<u>Question 2</u>:** **Do you agree with the following statement? "Public funding should be preferentially allocated to understanding it and addressing it."**	**<u>Question 3</u>:** **Do you agree with the following statement? "Czechia should preferentially allocate public funding for this area compared to the other areas to support research, development and innovation by SSHA."**	**<u>Question 4</u>:** **If you were to select only exactly 6 areas in Question 3, which ones would it be?** *Choose exactly 6 areas.*	**<u>Question 5</u>:** **What expected impacts and challenges in the given area are, in your opinion, the most significant for the future quality of life in Czechia?** *Please name them.*
Area 1	**choose from the offered options** [scale from definitely no to definitely yes]	**choose from the offered options** [scale from definitely no to definitely yes]	**choose from the offered options** [scale from definitely no to definitely yes]	Yes/No	
Area 2...	**choose from the offered options** [scale from definitely no to definitely yes]	**choose from the offered options** [scale from definitely no to definitely yes]	**choose from the offered options** [scale from definitely no to definitely yes]	Yes/No	

Annex 3 – List of studies used for the background research

- Centrum pro sociální a ekonomické strategie, UK (2011). *Klíčová ohrožení a příležitosti rozvoje České republiky do roku 2025*
- WBGU (2011). *World in transition – A social contract for sustainability*
- Copenhagen Research Forum (2012). *Visions for Horizon 2020*
- SCIRO (2012). *Our Future World*
- ISS; ESPAS (2012). *Global trends 2030 – Citizens in an interconnected and polycentric world*
- STERIA (2012). *The Future Report 2012*
- Chatham House and FRIDE (2013). *Empowering Europe's Future*
- ESPAS (2013). *The Global Economy in 2030: Trends and Strategies for Europe*
- Finish Government (2013). *Finnish Government Report on the Future*
- Oxford Martin School (2013). *Now for the Long Term - The Report of the Oxford Martin Commission for Future Generations*
- RAND Europe (2013). *Europe's Societal Challenges*
- The Atlantic Council of the United States (2013). *Envisioning 2030: US Strategy for the Coming Technology Revolution*
- EPA Sweden (2014). *Impact assessment of global megatrends*
- ESPON (2014). *Making Europe Open and Polycentric. Vision and Scenarios for the European Territory towards 2050*
- KPMG (2014). *Future State 2030*
- Oxford Martin School (2014). *Future Opportunities, Future Shocks: Key Trends Shaping the Global Economy and Society*
- RAND Europe (2014). *Foresight Services to support strategic programming within Horizon 2020*
- European Environmental Agency (2015). *SOER 2015*
- ESPAS (2015). *Global Trends to 2030: Can the EU meet the challenges ahead?*
- European Commission (2015). *The Knowledge Future: Intelligent policy choices for Europe 2050*
- Danish Agency for Science, Technology and Innovation; OECD (2016). *An OECD Horizon Scan of Megatrends and Technology Trends in the Context of Future Research Policy*
- U.S. National Intelligence Council (2016). *Global trends: The Paradox of Progress*
- Úřad vlády České republiky (2016). *Zhodnocení vazeb mezi vybranými globálními megatrendy a jejich vlivu na vybrané klíčové oblasti rozvoje České republiky do roku 2030*
- Havránek a Pokorný (2016). *Globální megatrendy pro aktualizovaný Strategický rámec udržitelného rozvoje*

- World Economic Forum (2016). *The Global Risks Report 2016*
- EPRS (2017). *Global Trends to 2035 - Geo-politics and international power*
- EPRS (2018). *Global Trends to 2035 - Economy and Society*
- AXA (2019). *THE AXA 2019 FORESIGHT TRENDBOOK*
- ESPAS (2019). *Global trends to 2030: Challenges and Choices for Europe*
- AXA (2020). *The 2020 Future Risks Report*
- Oxfam (2020). *GLOBAL MEGATRENDS - Mapping the forces that affect us all*
- World Economic Forum (2020). *The Global Risks Report 2020*

Annex 4 – List of interviewed experts during the background research

- Alexander Sokolov - HSE University (Moscow)
- Anita Pirc Velkavrh - European Environmental Agency
- Axel Zweck - Aachen University
- Ben Martin - University of Sussex
- Danièle Réchard - European Parliament - Global Trends Unit
- Duncan Cass Beggs - OECD Foresight Unit
- Ed Dammers - PBL Nethlerlands
- Edgar Goll - IZT - Institute for Futures Studies and Technology Assessment
- Filippo Artuso - Oxfam
- Florence Gaub - EUISS
- Florian Klein - Deloitte
- Hordur Haraldsson - Naturvardsverket - Swedish Environmental Protection Agency
- Irene Guijt - Oxfam
- Jamal Shahin - Vrije Universiteit Brussel
- Jerome C. Glenn - The Milllenium Project
- Jochen Markard - ETH Zurich
- Jonathan Boston - Wellington School of Government
- Karlheinz Steinmuller - Z_punkt The Foresight Company
- Kerstin Cuhls - Fraunhofer Institute for Systems and Innovation Research ISI
- Klaus Kammer - FOEN - Federal Office for the Environment (CH)
- Kuniko Urashima - NISTEP
- Laurent Bontoux - European Commission - Strategic foresight
- Lorenzo Benini - European Environmental Agency
- Maciej Krzysztofowicz - European Commission - JRC (Policy Lab)
- Marleen Van Steertegem - VMM - Flanders Environment Agency
- Mathias Weber - Austrian Institute of Technology

- Michael Clemence - Ipsos Mori
- Michael Jackson - Shaping Tomorrow
- Michael Keenan - OECD - Directorate for STI
- Mikko Dufva - SITRA
- Nikolaos Kastrinos - European Commission - DG for Reseach and Innovation
- Olivier Desbiey - AXA
- Osmo Kuusi - University of Turku
- Owen White - CEP - Collingwood Environmental Planning
- Patricia Lustig - LASA Insight Ltd
- Peter C. Bishop - Teach the future
- Radu Gheorghiu - Institutul de Prospectiva
- Scott Smith - Changeist
- Tatiana Chernyavskaya – formerly UNIDO
- Ulrich Lorenz - Federal Environmental Agency (GER)
- Ward Munters - Leuven Centre For Global Governance Studies

Tento projekt je financován se státní podporou Technologické agentury ČR v rámci programu BETA2

www.tacr.cz
Výzkum užitečný pro společnost

Úřad vlády České republiky

ČESKÉ PRIORITY