ITT 537-3

MATHEMATICAL FUTURES PROGRAMME. MATHEMATICS EDUCATION POLICY IN THE FUTURE: Landscaping Mathematics Education Policy (LOT 1 & LOT 2)

# Introduction

The Royal Society (the Society) is a registered charity, the national academy of science in the UK and a self-governing Fellowship of many of the world’s most distinguished scientists drawn from all areas of science, engineering, and medicine.

The Society’s fundamental purpose, reflected in its founding Charters of the 1660s, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity. The Society has played a part in some of the most fundamental, significant, and life-changing discoveries in scientific history and Royal Society scientists continue to make outstanding contributions to science in many research areas.

A major activity of the Society is identifying and supporting the work of outstanding scientists. The Society supports researchers through its early and senior career schemes, innovation and industry schemes, and other schemes. The Society facilitates interaction and communication among scientists via its discussion meetings and disseminates scientific advances through its journals. The Society also engages beyond the research community, through independent policy work, the promotion of high-quality mathematics, science and computing education, and communication with the public.

As the national academy of science in the UK, the Royal Society feels that it is time to consider and debate the role of mathematics in education in securing prosperity and wellbeing for individuals and our society. The Society has therefore established the Mathematical Futures programme (MFP) which aims to build a new vision of mathematics education that anticipates and supports the role of mathematics for individuals, education, economies, and society, strengthening diversity and reducing inequity. The Society is committed to excellence in all that it undertakes and asks all its partners and Suppliers to share this commitment.

The purpose of this Tender is to engage a Supplier or Suppliers to provide research which shall detail evidence to inform its Mathematical Futures Programme. The Services are described in detail in the specification and broadly comprise the following two work packages:

Work package 1

1. Evidence syntheses of the following:
	1. Chronological mapping of mathematics education policy interventions in England. [[1]](#footnote-2)
	2. Trend impact analysis and interpretation of policy, trajectories and system changes relating to mathematics education to extrapolate from historical policy trajectories to inform the future.
2. Expert views based on virtual interviews and workshops.
3. Drawing of implications for and from mathematics education policy and practice.

Work package 2

1. Horizon scanning of key international mathematics education practices and developments and to identify potentially important future developments.
2. Expert views based on survey, virtual interviews, and workshops.
3. Drawing of implications for and from mathematics education policy and practice.

The Society will work with the Supplier/s to confirm timeframes and start dates based on delivery of the other Work Packages in this ITT (537-3) and in ITT 537-2. The timeframes will be discussed and updated in regular project management meetings with the project team. The timings of these projects which are provided in Section 5 will need to run in sequence as follows:

* ITT (537-2) Work Package 1, ITT (537-3) Work Packages 1 and 2; followed by
* ITT (537-2) Work Package 2.

# Context

The Royal Society’s work in education policy focusses on creating the conditions for young people to receive a broad, balanced and connected education. It aims to equip them with the knowledge, skills and resilience that will enable them to successfully navigate and thrive in an uncertain world that is being transformed by digital technologies that are expected to change the types of jobs that will be available in future. This policy work addresses priority areas such as mathematical and quantitative skills, sciences, and computing education. Digital technologies are transforming our lives, including changing the types of jobs that will be available in future.[[2]](#footnote-3) Whilst there has been a rapid increase in the demand for data science skills, there is uncertainty about when and which jobs will cease and what new types of jobs there will be. The mathematical needs of people in the UK should be better understood than they are now, and our education systems configured to provision them.

Accordingly, the Royal Society’s Mathematical Futures Programme (MFP) Board has determined that the main aims of the MFP are to:

1. Understand the mathematical competences that will be needed by students leaving compulsory education and training in the future.
2. Consider the implications of reshaping mathematics education for 4–19-year olds.
3. Recognise the skills required for teachers who would teach these curricula.

These aims are centred around two core questions:

1. What mathematical competences will be needed for society to thrive in the future?
2. How should education systems develop these mathematical competences?

In the MFP, the term mathematics is used inclusively, covering a variety of ways of thinking, reasoning, and solving mathematical problems which touch on many aspects of everyday life, work and study (in mathematics as well as in other subjects/disciplines). It includes quantitative skills and other activities of a mathematical nature such as those associated with numeracy, statistics, computing, and data analysis. Mathematical competences cover the way mathematical concepts, skills and understanding as well as attitudes are brought together when applying mathematics to solve problems.

The programme seeks to look at mathematical competences for diverse needs across disciplines, not only from different areas of mathematics and natural science, but also from the social sciences and humanities. The scope covers the phases between the start of compulsory education and entry into higher or further education.

The MFP is concerned with the mathematical needs of all young people progressing through compulsory education and preparing for diverse futures, including those who in their daily lives require:

1. basic functional numeracy for personal decision making.
2. mathematical literacy to understand and critique numerical claims.

and/or who work in:

1. traditionally non-quantitative jobs/professions, but requiring mathematical expertise: e.g., lawyers, journalists, civil servants, politicians, health practitioners, administrators, teaching practitioners (not mathematics), technical and vocational professions – including technicians.
2. jobs/professions where mathematical competences are a core component, e.g. analysts, engineers, financial professionals, scientists, social scientists.
3. mathematical sciences, e.g. mathematicians, mathematics teachers.

In Phase I, the MFP has initiated three projects to collect evidence and findings. Phase I is interested in how the genesis of mathematics and mathematics education policy, which plays a major role in the orientation on present and future, can inform and shape a future vision of mathematics and its education for the next generation. The evidence gathered in Phase I will then be used to shape the next set of projects in Phase II which is seeking to provide a vision for what the mathematical education landscape should be for the next generations of students.

In this Invitation to Tender (ITT 537-3), seeks tender submissions from Suppliers for Project 3 of the MFP, which is separated into Work package 1 and Work package 2. The Society has appointed Suppliers for Project 1, and a separate Invitation to Tender (ITT 537-2) has been launched for Project 2 at the same time as this tender.

**Project 1** (RFQ 537-1). Call for Views on the changing nature of mathematics and implications for education

1. The Call for Views was launched on 9 October 2020 and closed in mid-January.
2. Over 150 responses were received from members of the public in a range of industry sectors.
3. The analysis of the Call for Views responses and evidence due to be completed in May 2021 will inform Projects 2 and 3.

**Project 2** (ITT 537-2). Mathematics in the future: Evidence and scenarios for the importance and value of mathematics in the future

1. This project seeks to investigate the importance of mathematics (as defined above) to citizens’ future lives and jobs.
2. It is concerned with understanding the changing nature of mathematics and the impact such changes may have on education.
3. The evidence will involve foresight planning to propose several alternative scenarios for the future of mathematics.
4. Scenario planning will be informed by outputs from Project 3 (ITT 537-3).
5. The project aims to make recommendations relating to each scenario and inform the next phase of the MFP.

**This Service: Project 3** (ITT 537-3). Mathematics education in the future: Landscaping mathematics education policy

1. This project is an evidence synthesis which aims to bring together information from a range of sources to provide an accurate, concise synthesis of national education policy patterns and approaches to enacting change and impact in education over the past few decades (e.g. since the emergence of GCSEs in England). [[3]](#footnote-4)
2. The project uses horizon scanning techniques and aims to identify key mega-trends in mathematics education policy in international jurisdictions and to consider the opportunities and threats to achieving the vision based on understanding of educational change.
3. The project aims to inform scenario planning in Project 2 (ITT 537-2).
4. The project aims to draw implications for future policy planning and realising the MFP ambitions.

# Research Services Requirements

The purpose of this Invitation to Tender is to engage a Supplier or Suppliers to provide Services in accordance with the details and specification enclosed herewith for Project 3: *Landscaping and Horizon Scanning*.

The successful Tenderer/s shall provide research consultancy services to use futures thinking methodologies to map on national and horizon scan international mathematics education policy. The reports will then be used to inform future scenarios, each with a set of recommendations against each scenario in Phase II to shape the MFP’s vision for mathematics education in the future. The detailed timeline for the completion of the Services is at Item 5 of this Brief.

The research commissioned shall stimulate thought and inform debates about system-wide issues in mathematics education. It is envisaged that this project shall enable the MFP to understand the plausibility of its proposed future scenarios for mathematics education, the risks, and possible mitigations to achieving the necessary changes.

The proposed report(s) shall address the following questions:

1. How has mathematics education (in England) been shaped by education policy and educational change more generally since the late 1980s?
	1. What policy interventions, both direct and indirect, have influenced mathematics education in 2021?
	2. What were/are the motivations and intentions for these policy initiatives?
	3. How effectively were the policy intentions realised and communicated?
	4. How can understanding of past policy and change trends inform thinking about future possibilities?
2. How can international comparisons and horizon scanning tell us about high-performing practices, policy initiatives and future directions of travel in mathematics education?
	1. What are the key policy trends and education practices in mathematics education within high performing jurisdictions?
	2. What are the current international trends in mathematics education and how are these impacting national mathematics education agendas?
	3. How can international comparison and trends inform thinking about future possibilities for mathematics education in England?

The analysis will draw on a framework to be proposed by the supplier and agreed with the Royal Society but that might include eight themes: curriculum, qualifications and assessment, pedagogies, resources, and technologies, teaching workforce, incentives and drivers, systems and structures, international comparisons.

At the end of the Service it is envisaged that the successful Tenderer/s shall provide the Society with a detailed and thorough written report(s) and other outputs (see Sections 4.1.2 and 4.2.2 below) containing the findings that have emerged from the research and shall have the opportunity to discuss the findings informally with the research team(s) in a dedicated meeting and present the findings to the MFP Programme Board in a meeting.

The Royal Society intend to create an action plan based on the findings, in order to carry out individual projects with suitably expert partner organisations in the following 24-36 months and help education policy makers develop the policies needed to adapt to the increasing need for mathematical competences in the future. The expectation is that the project will explain how past and current policy initiatives have evolved. The futures thinking around of national and international developments will provide the programme with policy memory and understanding to inform future policy scenarios based on features of successful or unsuccessful policy making. This project will thus provide perspectives and insights that will contribute to systematic examinations of the future of mathematics education.

# Services Work packages

There are two discrete work packages (or Lots) in this Specification (537-3). Tenderers are invited to submit tenders for one or both work packages which are detailed below.

* Work package 1 (WP1) is related to the first research question and involves the production of an evidence synthesis and chronological mapping of national mathematics education policy over the past few decades.
* Work package 2 (WP2) is concerned with the project’s second research question and involves horizon scanning of international mathematical policy trends and developments in high performing jurisdictions over the past five to ten years.

## Work Package 1. Landscaping national mathematics education policy

### WP1 Approach

WP1 is an evidence synthesis concerned with key initiatives and reforms in mathematics education policy since the late 1980s. Evidence synthesis refers to the process of bringing together information from a range of sources and disciplines to inform debates and decisions on specific issues.[[4]](#footnote-5) An accurate, concise and unbiased synthesis of the evidence will make valuable contributions in shaping the MFP in Phase II. WP1 aims to produce a chronological map of national mathematics education policy over the past four decades to provide an aide for reflection upon the changes and shifts in major mathematics education policy interventions and what can be learned for the future.

WP1 explores the genesis of mathematics education in order to stimulate thinking about future policy. The chronological mapping will involve identifying and synthesising key policy reports and interventions in mathematics education across England to support the interpretation of each initiative. The analysis will focus on White Papers, Green Papers, reports, and reviews commissioned by central government and changes to legislation and government departmental remits over the relevant period. It is envisaged that the analysis of these policy interventions will identify how these national interventions, reforms and changes affecting mathematics education were enacted. To support the chronological map, WP1 will produce a database of the evidence used.

Based on the historical analysis including a chronological and contextual overview of policy areas with implications for the future, WP1 will use expert validation of the interpretations about mathematics education policy initiatives, priorities, changes and reforms. Based on expert views, WP1 will extract reflections on lessons and messages, especially where changes or improvements may be hidden because they may not be due to an explicit policy or may not be documented.

### WP1 Outputs and timescales

The successful Tenderer/s shall deliver the following outputs:

| **Deliverable** | **Deadline for submission** |
| --- | --- |
| An evidence synthesis report to include the following topics:1. Chronological map
2. Characterise the chronology and what it can tell us about changing policy actors and influencers.
3. A high-level visualisation of the main trends, milestones and causal links that have shaped current mathematics education initiatives in England.
4. Produce a databased of the evidence used.
5. General education policy that influence change in mathematics education policy.
 | 5 October 2021 |
| 1. Expert views in workshops and/or (virtual) interviews:
2. Gather prominent stakeholder views identified in collaboration with the Society about mathematics education policy initiatives, priorities, changes, and reforms using workshops and questionnaires where participants consider which significant change is possible.
3. Provide reflections on lessons and messages about the public rationale for policy moves.
4. Evaluate systems and policies adopted: values, philosophies, context, purposes, priorities, and perspectives in mathematics education policy.
5. Provide a narrative of each main intervention included in the chronological map.
 | September 2021 |
| 1. Report of evidence synthesis of policy interventions over the past 40 years:
2. Focus on identifying change and dynamic perspectives in mathematics education and refer to broader education policy where this is relevant to and impacts mathematics education, e.g. accountability, academisation.
3. Capture changes or improvements which happened despite of rather than because of national policy developments to understand the following:
	* Cases where impact of policy on practice may sometimes be uncertain.
	* The interaction between various education policies and their effects.
	* The drivers and barriers to implementing/enacting policy, including issues such as:
		+ The intentions and delivery strategies, e.g. continuous professional development of teachers, the communications strategy and public affairs activities that supported policy implementation, or wider social and political narratives that were driving education policy changes.
		+ The importance of stakeholders in determining whether a policy initiative lands successfully, e.g. examples of ways in which the changes arising from these policy initiatives were communicated, e.g. to parents, teachers, unions, wider society or responses in the media.
4. How the impact of various mathematics education policies has been measured and/or evaluated.
5. Significant implications for future policy in mathematics education.
6. Each intervention will be described and analysed against eight themes, context and factors that shaped it, variation in the impact and enactment of the intervention, including intended consequences or impact, unintended consequence, positive impact, negative impact, longevity and main policy actors.
7. Identify critical issues and trends.
8. Identify drivers of change through a systematic examination of both the education operating environment and also other industries to identify critical changes, opportunities and threats shaping education futures.
9. Case studies of key developments, including short narratives across themes with reference to the four Nations of the UK.
10. Vignettes of policy interventions (about 1000 words each) across the UK Nations.
11. Advice to the MFP Board on how this analysis can support thinking about the opportunities and barriers to policy and system change, and the potential for realising future visions for mathematics education.
 | 5 October 2021 |
| 1. A final report of the detailed analysis of the evidence
2. Provide an interpretation of the mapping of national mathematics education policy.
3. Confirm or refine the eight themes above.
4. Extract lessons from the past and present to inform a vision for the future and the extent and pace of change that is possible.
5. Identify emerging policy challenges and opportunities.
 | 8 November 2021 |
| 1. Presentation of analysis
 | Beginning of December 2021 |

## Work Package 2

### WP2 Approach. Horizon scanning of international policy initiatives

WP2 is seeking to identify trends in mathematics education policy in international jurisdictions and involves horizon scanning of the mega-trends in global reforms and policy changes in mathematics education to understand how current education policy developments can inform future policy. The research will provide reflections on developments in mathematical, statistical thinking, data literacy, and computational thinking and how these global developments compare to current trends in England.

It is expected that WP2 will involve horizon scanning for identifying potentially important international policy developments through a systematic examination. This meta-analysis will focus on changes over time internationally, key influences, and impacts/effects. Further, the research will determine what is constant in mathematics education policy internationally, what is changing or is constantly changing. In this way, WP2 will explore trends, including matters at the margins of current thinking that challenge past assumptions. WP2 will help the MFP Board understand the big picture behind international mathematics education policy issues. The expectation is that the research will involve a wide variety of sources, such as the Internet, government ministries and agencies, non-governmental organisations, international organisations and companies, research communities, and on-line and off-line databases and journals.

The successful Tenderer shall deliver the following activities:

* Horizon scan current policy developments internationally for each of the eight themes using a range of techniques such as questionnaires, workshops, and in-depth interviews on specific aspects with international experts in the education sector.
* Consider the extent to which global initiatives and trends have impacted on UK policy in the past five to ten years.
* Identify global reform movements which are likely to shape mathematics education nationally in the future.

### WP2 Outputs and timescales

The successful Tenderer shall deliver the following outputs:

| **DELIVERABLE** | **DEADLINE FOR SUBMISSION** |
| --- | --- |
| 1. Engagement with experts to inform the findings
	1. Conduct (virtual) workshops with experts in international mathematics education to share their perspectives and knowledge with each other to 'scan' how new phenomena might influence the future.
	2. Questionnaires and (virtual) in-depth interviews on specific aspects with international experts in the education sector.
 | July 2021 |
| 1. A report of relevant international evidence in mathematics education.
	1. Relevant to the programme’s aims and core questions
	2. Case studies of interesting innovations, changes and developments in mathematics education of national innovations/change in international jurisdictions (within-country, e.g. Singapore, the four Nations of the UK).
	3. The ways in which the changes arising from these policy initiatives were communicated to (i) parents (ii) teachers (iii) unions (iv) wider society and (v) responses in the media.
	4. Propose strategies for anticipating future international developments, innovations or trends in mathematics education (across-countries, e.g. PISA).
	5. Assess trends to feed into a scenario development process.
 | 20 September 2021 |
| Presentation of analysis | 20 September 2021 |

# Project Timescales

The tender submission, evaluation and agreement award timelines are provided at Item 6 of the **Instructions to Tenderers** document. The table below details the key dates for the Services. A programme Gantt chart is in Appendix 1.

|  | PROJECT STAGE | DATES |
| --- | --- | --- |
| 1 | WP1: Contract signed and executed | 23 April 2021 |
| 2 | WP1: Kick off meeting | 26 April 2021 – 30 April 2021 |
| 3 | WP1: Evidence synthesis | 3 May 2021 – 31 August 2021 |
| 4 | WP1: Engagement with experts | September 2021 |
| 5 | WP1: Drafting of report | 30 September 2021 – 7 October 2021 |
| 6 | WP1: Peer review of report by the MFP Board members | 8 October 2021 – 22 October 2021 |
| 7 | WP1: Finalisation of report | 25 October 2021 – 8 November 2021 |
| 8 | WP2: Contract signed and executed | 23 April 2021 |
| 9 | WP2: Kick off meeting | 26 April 2021 – 30 April 2021 |
| 10 | WP2: Horizon scanning of international initiatives | 3 May 2021 – 30 June 2021 |
| 11 | WP2: Engagement with experts | July 2021 |
| 12 | WP2: Drafting of report | 19 July 2021 – 19 August 2021 |
| 13 | WP2: Peer review of report by the MFP Board members | 20 August 2021 – 3 September 2021 |
| 14 | WP2: Finalisation of report | 6 September 2021 – 20 September 2021 |

# Governance

The programme is overseen by the [Royal Society Advisory Committee on Mathematics Education](https://royalsociety.org/about-us/committees/advisory-committee-on-mathematics-education-acme-5/) and the Mathematical Futures Programme Board, both chaired by Professor Sir Martin Taylor FRS.

# Resources

The successful tenderer shall:

1. Demonstrate a systematic approach to project management and adhere to project milestones and timelines;
2. Deliver the work within the agreed budget and timeframe; and
3. Be flexible to the changing needs of the Royal Society and the programme and be able to adjust to reasonable requests and/or demands within reason.

The Society shall provide guidance and support to the successful Supplier in all matters relating to the working practices of the Royal Society. The successful Tenderer/s shall work in partnership with the Society’s internal programme team in the following areas:

| THE SOCIETY INTERNAL TEAMS/RESOURCE & ROLES |
| --- |
| 1. Programme lead and oversight. |
| 2. Programme coordination.  |
| 3. Press and media relations. |
| 4. Access to expertise in the areas of interest to the programme (either by open invite or invitation only depending on audience group). |
| 5. External promotion and reporting of the project outputs on social and other marketing/media channels. |
| 6. Design of event collateral and some animated content (if required). |
| 7. Liaison with the Royal Society’s internal teams, colleagues and external stakeholders. |
| 8. Participation in project and planning meetings. |
| 9. Sign-off and authorisation of all project outputs, materials and communications. |
| 10. Speaker liaison for participation in stakeholder workshops (as required). |

# Budget

The estimated total budget for the Services for both work packages in this project is up to a cost of £60,000 (VAT inclusive).

The budget split between each work package is as follows:

1. WP1 - £30,000 to £40,000 (VAT Inclusive)
2. WP2 - £15,000 to £20,000 (VAT Inclusive)

Tenderers shall state which of the work packages they are tendering for in their submission by using the Pricing Schedule at Attachment 5 of the tender pack. Please provide justification for your proposed costs in line with your research approach by providing a detailed breakdown of your offering and associated costs.

Tenderers are asked to bear in mind that the Society is a registered charity and the MFP is partially funded by government grant funding Tenderers are requested to provide as much detail as possible in their pricing.

# Appendix 1. Programme Gantt Chart



|  |  |  |
| --- | --- | --- |
|  | 2021 | 2022 |
| Project and work package | April | May | June | July | August | September | October | November | December | January | February | March |
| Project 1 (ITT 537-1) |  |  |  |  |  |  |  |  |  |  |  |  |
| **Project 2: WP1 (ITT 573-2) (this tender)** |  |  |
| **Project 2: WP2 (ITT 573-2) (this tender)** |  |
| Project 3: WP1 (ITT 573-3)  |  |  |
| Project 3: WP2 (ITT 573-3)  |  |  |

1. Note that the primary focus of the Mathematical Futures Programme is on England, with a wider interest in the UK policy developments and changes. [↑](#footnote-ref-2)
2. https://royalsociety.org/news/2018/09/the-impact-of-ai-on-work/ [↑](#footnote-ref-3)
3. Note that the primary focus of the Mathematical Futures Programme is on England, with a wider interest in the UK policy developments and changes. [↑](#footnote-ref-4)
4. https://royalsociety.org/topics-policy/projects/evidence-synthesis/ [↑](#footnote-ref-5)